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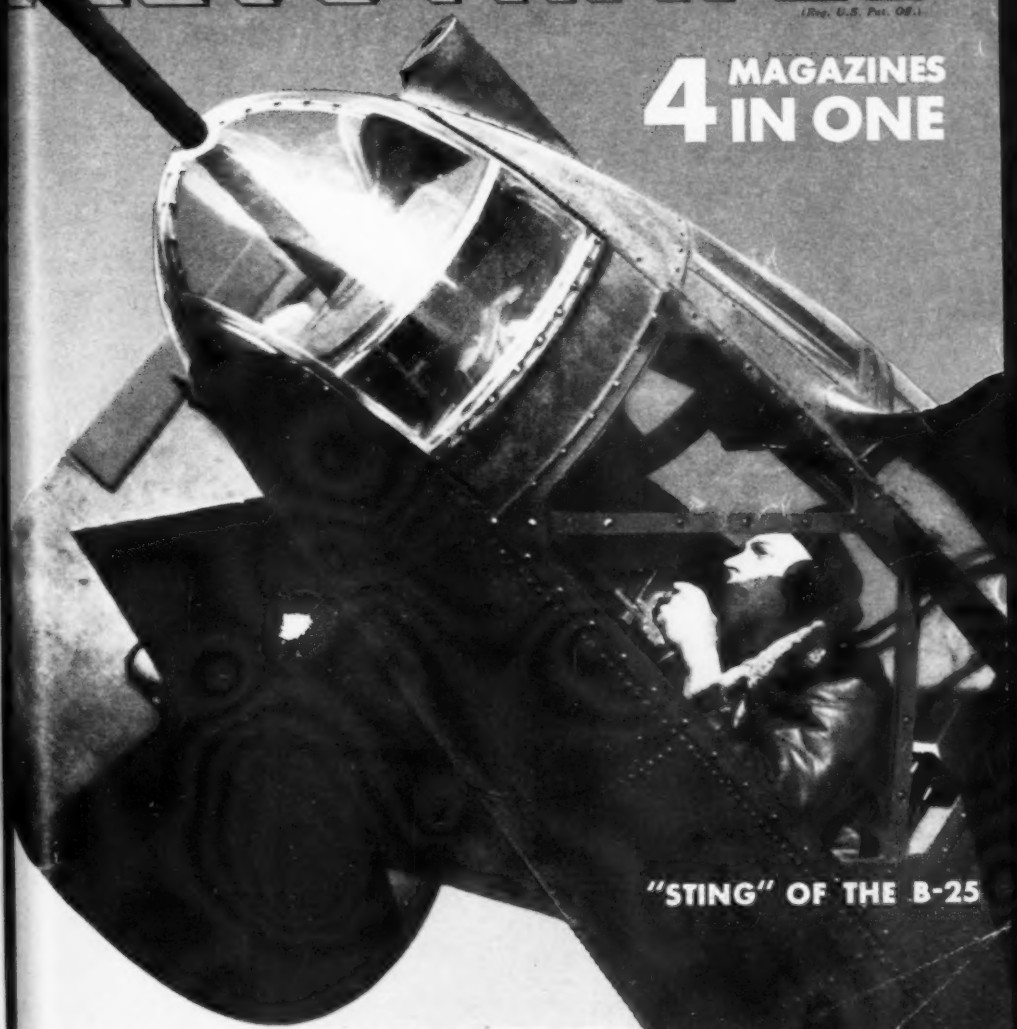

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...TENT INVENTION DEFEATS
...RPEDO ATTACKS - SEE PAGE 42

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MECHANIX ILLUSTRATED

JULY 1942

Volume XXVIII Number 3

W. H. FAWCETT, JR., President

Editors

Roland Cueva Bill Williams

Associate Editors: George Daniels, *Aviation;* Norman C. Lipton, *Photography;* Charles D. Bonsted, *News;* Shirley Cutter, *Production*

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SPECIAL FEATURES

On the cover: The tail gunner in this Kodachrome view of a U. S. Army B-25 medium bomber by Rudy Arnold is Corp. Lyle Way, 22, of Lincoln, Nebr. It was hard-hitting B-25s like this that first bombed Tokyo.

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JOHN L. SCHERER

Long-time MI readers to whom the name of the author of the exciting, authentic article "Bombardier" on page 35 looked familiar, deserve credit for remembering old friends. For John L. Scherer, right now an RCAF F/O (Flying Officer), was an associate editor of MECHANIX ILLUSTRATED from June 1936 to mid-April 1939. Born in 1908, he built model planes as a boy, joined the National Guard Air Service in 1927, earned his pilot's license in 1934. Writing about planes and aviation progress for MI just sharpened his long-standing air interest, of course—so much so that he left to fly a plane for the Gannett Newspapers, visiting 46 states in less than two years. Then the RCAF attracted him as it had so many other U. S. flyers; he was commissioned in 1940.

NEXT MONTH

We could end the war in two months! That's what the world's most famous tank designer and builder, J. Walter Christie, says. Mr. Christie should know what he's talking about. There are 30,000 of his tanks on the Russian front today.

Next month, in as amazing an article as you ever read, Mr. Christie tells you HOW we can end the war in two months. Don't fail to buy an August MECHANIX ILLUSTRATED (on sale July 1) to read this outstanding interview with Mr. Christie by George Daniels.

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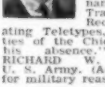

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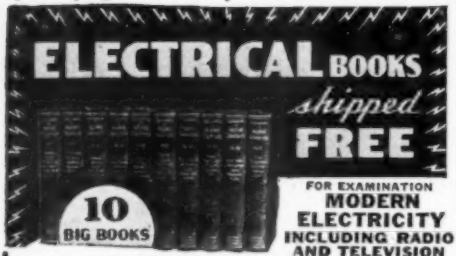

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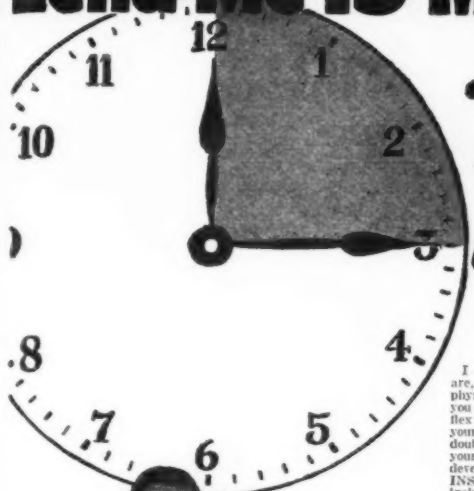
Lend Me 15 Minutes A Day

..and I'll prove I can make you a NEW MAN



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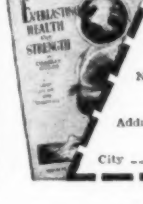

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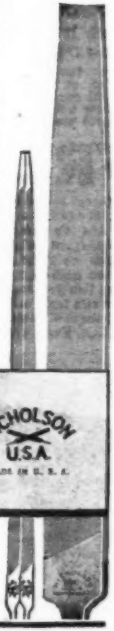

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but here is one worry you can avoid

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NEW PRODUCTS AND INVENTIONS

LATEST HOME AND SHOP DEVICES • POPULAR PATENT IDEAS

GOSSIP OF DEFENSE AND INVENTORS

by Morton Leese

Research work is not concentrated solely in the laboratories of big companies, according to a recent investigation of patents and research. It was found that small and medium-sized organizations spend approximately as much as large companies on experimental work and inventing. During 1941 a new record was set for financial outlay for research, the amount being $117,490,000. Only a small number of companies reduced their research budget for 1941. New inventions may furnish outlets for the peace-time utilization of war production plants.

* * *

The war having brought about a reduction in the supply of vitamin containing fish oils, it is not surprising to find activity in the discovery of new sources of the important vitamins. Soupfin shark, which are found off our Pacific coast, furnish an excellent source of vitamin A. The liver of this shark is worth $17,000 a ton, which is higher than the price of bar silver.

* * *

If your first action from the Patent Office on your application is a rejection, do not despair. It is rare indeed that a patent application is allowed on the first examination. In amending your application in response to a rejection, you should clearly point out all the patentable novelty which you believe is present in view of the examiner's rejection. You are permitted to make changes to comply with the official letter. And you may even arrange for a personal conference with the examiner who has charge of your application. However, interviews involve additional expenses and ordinarily a response by letter is sufficient.

* * *

If you appoint a patent attorney to represent you before the Patent Office with regard to an application, do not expect the office to conduct a double correspondence with both you and your attorney. In the event you assign your entire interest in

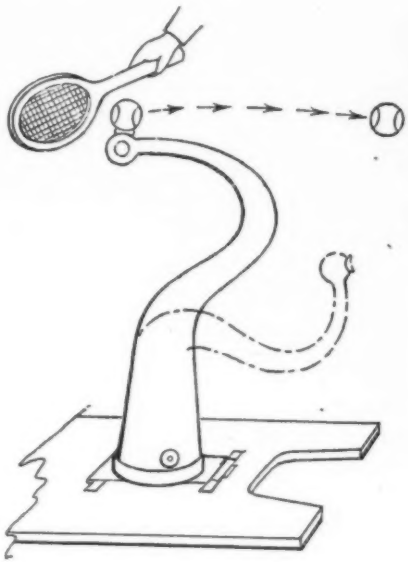
Recently introduced, this special hammer finish kit provides a quick-drying coat for the familiar type of metallic surface used on many types of articles. It can be applied as shown.

This newly perfected door handle is intended to add both beauty and convenience to the door. To open the door, the handle is simply pulled outward a distance of about half an inch at the end. Little pressure is required, permitting it to be operated by persons laden with packages, etc. Invalids in wheel chairs can unlatch door with cane or stick.

Available only for low-cost housing projects, this specially designed "package" unit will do the basic cooking job for a small family. It operates entirely on electricity, and is economical to use. Several hundred have already been sold to a housing development of the Glenn L. Martin Co. The unit affords a saving in both initial cost and in the installation cost, as no special wiring is required.

your invention, the person who thus owns the invention can exclude you from correspondence with the office on the invention. A double correspondence with the inventor and the assignee will not be conducted by the Patent Office.

* * *



A new tennis practice device, which is claimed to be helpful in the improvement of all phases of footwork, approach, handling of the racket and service stroking, has recently been patented. The practice aid includes a resilient flexible inflated rubberized portion, the upper portion of which has the shape of a return loop. At the end of the loop there are three pockets separated by 90 degrees from each other. The pockets are used to hold a tennis ball. By fastening the device in a vertical position and placing the ball in the top pocket, the device can be used for forehand or backhand drives. For service practice, the flexible arm is attached to a post in a horizontal position. The rubber arm, when struck at the same time as the ball is stroked, gives a feeling of resistance which simulates actual play. The device does not bound back to interfere with follow through. (No. 2,272,765.)

* * *

To eliminate the necessity of frequent windshield cleaning, and to furnish clear and unobstructed vision, an inventor has devised a removable transparent liner material which feeds from a fresh roll to a take-up roll. Both rolls are

[*Continued on page* 148]

INVENTORS

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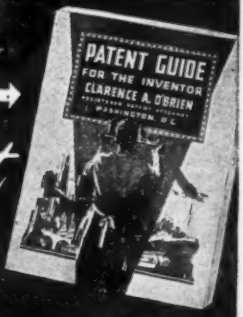

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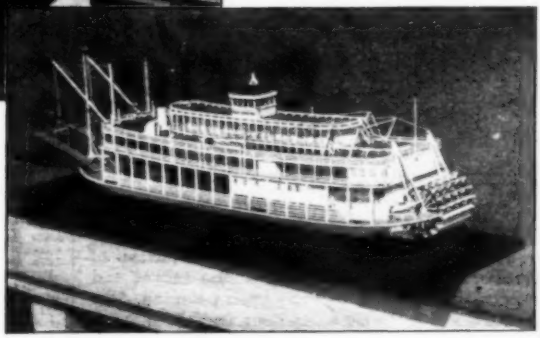
Chips FROM THE Editor's Workbench

Mr. B. Clark, of 10019 Diamond Drive, St. Louis, Mo., is shown at the left, holding his scale model of the packet "Golden Eagle" which used to run on the Mississippi-Illinois waterways. In the background is the pilot house of Mr. Clark's present boat, so it's easy to understand where he got his knowledge of boats, and also the urge to build so accurate and detailed a model. The pictures were taken by Radio Operator M. J. Taylor aboard the Str. "Kansas City." The photo below shows the intricate detail work of the 28-inch model. The paddle wheel alone took about three weeks to make. This month's $5.00 Workbench first prize and a Certificate of Merit go to Mr. Clark for this excellent job.



Contest L'envoi

THE great MI "Words-Within-Words" Contest is finished and the winners are announced on pages 54 and 55 of this issue. For the nearly 50,000 of you who submitted entries but failed to win prizes, we reproduce the prizewinning entry of W. O. Holton, Dallas, Texas, on pages 56 and 57.

Between 100 and 150 contestants submitted entries with higher totals than that of Mr. Holton. Some of the entries, which were obviously incorrect, reached totals as high as 5,000. These people just failed to follow the rules. Two or three obviously "made-up" words, which probably appeared on commercial "word lists" sold to some contestants, tripped up most of the rest. Oddly enough, the greater number of these people were ruled out for use of the word, "Escharae"—all of them maintaining that this was the plural of the word, "Eschara," found in Webster's New International Dictionary, Second Edition. This is plain nonsense, since no such latinized plural for this word is given in the dictionary and if any plural did exist it would, therefore, be formed by following the regular rule, by adding an "s." To be positive of this, The Editors asked the G. & C. Merriam Company, publishers of the dictionary, for a specific ruling on the word. They ruled that the plural is nonexistent. The same is true of another "made-up" plural, "Circaeaea," which a number of contestants used.

A great many other entries lost out in the judging because the contestant tried to create a new word instead of sticking to the words to be found in the dictionary. Many persons used the alleged word, "Grooters," and a good many other words of this nature. They argued that a "grooter" was "one who groots," from the verb, "to groot," which is given in the dictionary. Actually, though, no such word appears in the dictionary—and, hence, no such word exists. In every case where such a type of word does exist, it is so given in the dictionary. For example, see, "Move," and, "Mover—one who moves"; or, "Grin," and, "Grinner—one who grins."

Among the entries were many that were highly novel. Several were made in the shape of model airplanes. One man went to the trouble of inscribing his words on sheets of copper plate in the form of bullets. He punched each letter and numeral of the entire puzzle into the copper.

Editor's Workbench Chips

Many entrants went to the trouble of having their puzzles machine-printed. A great deal of originality was shown in the art and handicraft work used to mount entries.

We shudder to think of the number of man-hours that were spent on the game. One contestant mailed us his work-sheets, showing exactly the steps he has taken in working out his entry. He had a stack of paper approximately four inches high. And he wasn't even a winner!

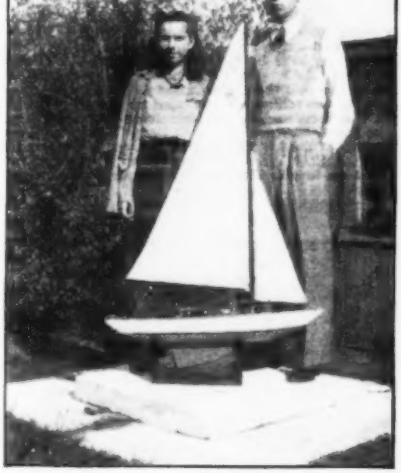
We're sorry all of you couldn't have won prizes. All of you deserve the greatest credit for the time and effort you expended. We believe, however, that most of you feel like another contestant who wrote:

"I haven't a chance to win, I know. But I want to thank you for the grand game. It was more fun and more educational than any contest I have ever seen."

It's been a lot of fun for us, too. So, here's to "Words-Within-Words"—and may you all be back again for our next contest!

Realism

YOU model bugs are in for a real treat next month—the August issue of MI will bring you a model the likes of which you just ain't never



Henry Loiselle, of 69 Johnson St., Somerset, Mass., built this trim little sailboat model. The boat, behind which he and his sister are standing, is 36 inches long. It carries 7 pounds of lead on the keel and has a mast 48 inches high. Mr. Loiselle tells us that he got the idea for his sailboat after seeing the model boat Popeye in HOW TO BUILD 20 BOATS a few years ago. He also says that his model sails very well in both heavy and light breezes. It certainly looks as though it could, and it brings a $3.00 Workbench award and a Certificate of Merit to its builder.

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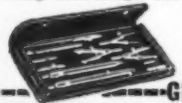

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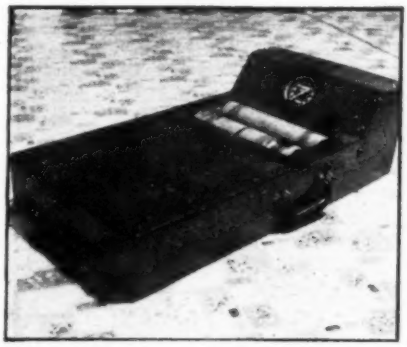
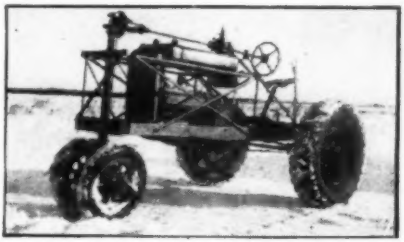
Editor's Workbench Chips

seen no place. We can truthfully say that this is about the most realistic model these editorial eyes have ever gazed upon. It's a model of an Army tank—the M-3 to be exact—and in small proportion will do practically anything its big brother will do. A remote control box speeds the model up, slows it down, maneuvers it in any desired direction, works the headlights, and fires wooden shells from a tiny replica 75mm. automatic cannon. This baby M-3 will climb steep hills, ride roughshod over obstacles and smash down barriers. Best of all, it's so amazingly simple, and the parts used so easy to get and so inexpensive, that even a beginner in model craft should be able to build one successfully. Don't miss it!



Two rolling pins, an automobile speedometer, and a worm gear arrangement from an old electric fan went into this speed tester for midget racing cars. The device was built by F. M. Clark, of 6548 C. V. Blvd., Hayward, Calif. Mr. Clark places his model car on the device with the engine running. The driving wheels turn the two rolling pins and send up the speedometer. He then tries various adjustments on the engine, and also tests different fuels—even tires. The combination that gives the highest reading is then, of course, the best. A $3.00 Workbench award and a Certificate of Merit go to Mr. Clark for this snapshot of his clever machine.



This well-built tractor is the work of J. O. Gangstad, of Chippewa Falls, Wis. Mr. Gangstad built the entire tractor himself from an old car. The only work not done in his own shop was the electric welding. It will pull a two-bottom, 14-inch plow. The speed of the tractor is from ten to fifteen miles per hour in high gear, and down to about 2½ miles per hour in low gear. A $3.00 Workbench award and a Certificate of Merit go to Mr. Gangstad for this snapshot of his tractor.

Editor's Workbench Chips

More MI Luck

WE'VE told you before about MI's seeming ability to foretell the future—how our issue bearing a cover picture of a PT boat hit the news stands just as Lieutenant Bulkley was performing miracles with his PT's in the Philippines; how our issue containing the first story on stratosphere bombing hit the stands as the first strato-bombing of Berlin was taking place, etc., etc. Now we have more to add to the story:

Several months ago, we asked Major Malcolm Wheeler-Nicholson, MI's military expert, to map out a plan of attack on Tokyo and tell our readers just how Tokyo could be bombed. It hit the news stands just as Tokyo was bombed! At that time, we had already selected our cover for the June issue—and that cover carried a picture of an American aircraft carrier. This issue, you will

Karl Brown's son Jimmie, is shown above as he swings the prop on his father's model sport plane. It has flown as long as 5½ minutes, and judging by young Jimmie's flying togs, he hopes to get a ride in it on one of those long hops. Mr. Brown senior and young Mr. Brown live in LaFollette, Tenn. A $3.00 Workbench award and a Certificate of Merit go to Karl for his excellent job in building his model plane.

"After reading the story 'New Plastic For Workshop Projects' by Ken Murray I thought the enclosed photo and item on a plastic chess set which I turned out, might be of interest for your Editor's Workbench Chips column." That's the way Leo W. Morrissey, of Bound Brook, N. J., begins his letter. The story about plastic for the workshop that he mentions is the one that ran in the March, 1942, issue of MECHANIX ILLUSTRATED. Mr. Morrissey, however, seems to have used his own ideas in making this beautiful chess set. Although he had no previous experience in handling plastics, he turned out the excellent job with his lathe and some hand tools. The time taken for the job was about 80 hours of spare time. This photograph of his handiwork brings Mr. Morrissey a $3.00 Workbench award and a Certificate of Merit.

You Also Serve

If You Work Efficiently in the Home Trenches

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Editor's Workbench Chips

notice, is a picture of the tail of a B-25 bomber. It, too, was selected before the bombing of Tokyo —and as you know, B-25's were used for that historic attack.

Altogether, we feel rather scary about the whole thing. Do you suppose we ought to use a cover picture showing Hitler being hanged—and then hope for MI luck to hold out?

Peek

IF YOU want to take a little peek into the future, into the post-War world, turn to page 62 and read the intensely interesting interview with Igor Sikorsky entitled, "Now You Can Fly Straight Up!" In the bustle of war news, few of us have realized what the remarkable Mr. Sikorsky has been doing with his helicopter recently. Apparently, however, the aerial flivver which George Spelvin can drive *has actually arrived!* It is here, *now!*

For the new helicopter seems to be as foolproof as any automobile. Anyone with a 50-foot lot and a garage can have one. You can park it on a downtown street more easily than you can park the family car. And Mr. Sikorsky says we are

Mr. Norris Coffman, of the Dixie Rustic Tavern, Huron and Central Ave., Mackinaw City, Mich., is the builder of this novel scrubbing machine. A ½-horsepower electric motor powers the device, and a Model A Ford crankshaft cut in half provides the reciprocating motion to two connecting rods which move a pair of large brushes back and forth. As the brushes are removable, sanding or polishing attachments may also be used. The machine was built from scrap parts and pipe fittings, with a base made from welded channel iron. It looks very efficient and undoubtedly keeps the floors of the Dixie Rustic Tavern spotlessly clean. In addition to that it brings its builder, Mr. Coffman, a $3.00 Workbench award and a Certificate of Merit.

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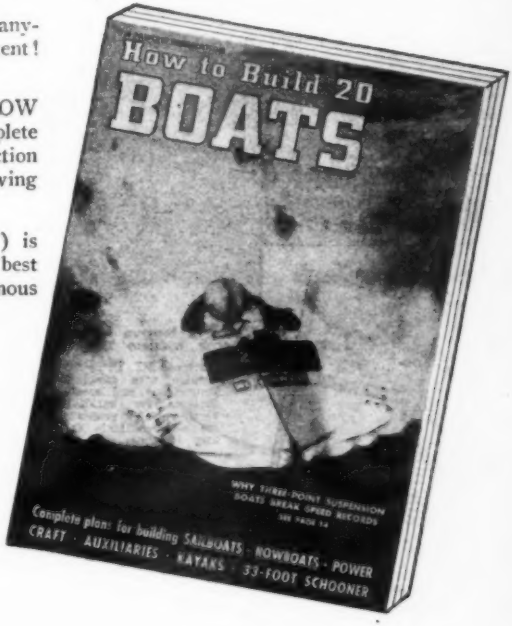
How to Build 20
BOATS
WHY THREE-POINT SUSPENSION BOATS BREAK SPEED RECORDS
SEE PAGE 14
Complete plans for building SAILBOATS · ROWBOATS · POWER CRAFT · AUXILIARIES · KAYAKS · 33-FOOT SCHOONER

20 NEW DESIGNS!

The 20 designs in this new edition were created by expert naval architects, have been thoroughly tested, *and are all new.* They range all the way from a 7-foot plywood pram (rowboat) to a 33-foot auxiliary schooner. Many of the boats are powered with auxiliary engines, varying from one-lungers of low horsepower to 85 horsepower V-8 conversions. You're sure to find a design that meets your needs in this book!

EASY TO BUILD!

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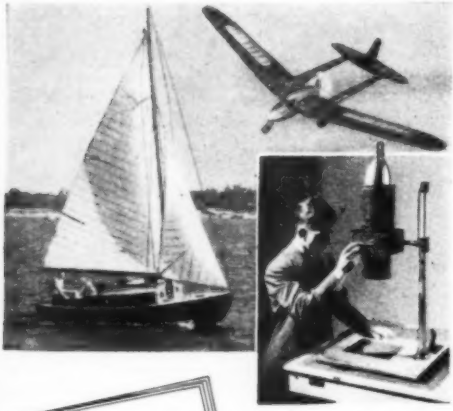

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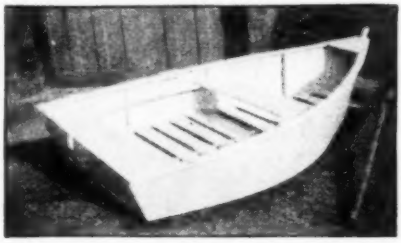
Editor's Workbench Chips

only waiting for the end of the war to mass-produce them.

It's an amazing piece of news, as you will find when you read our story. Personally, we're putting in our order for a heliflivver now.

Sea Otter

WE'RE immensely proud to be able to present in this issue "The Truth About the *Sea Otter*," written by the *Sea Otter's* originator and patentee, Warren Noble (see page 50). Mr. Noble is one of America's really great engineers. His radical cargo boat has grown to become a national "affair." Most everybody, from the President of



V. M. Carolin, of 77 Hamilton St., Sayville, N. Y., built this version of *Chip* from HOW TO BUILD 20 BOATS. He changed the specifications somewhat, giving her a slightly narrower beam than the plans showed. However, she performs nicely, and Mr. Caroline tells us that she can turn on a dime. She looks like a very nice job, and she brings her builder a $3.00 Workbench award and a Certificate of Merit.

This interesting "pan" head for a camera was made entirely from the adjustable unit taken from the base of an old electric fan. William E. Lyons, of 455 Second Street, Troy, N. Y., made it, and the only part of the whole device not taken from the fan, is the wood block that adapts it to the camera. It looks like a very workmanlike job, and it brings Mr. Lyons a $3.00 Workbench award and a Certificate.

Editor's Workbench Chips

the United States on down, has issued a statement about it. Up until now, no one has thought to ask the one man in the world best qualified to speak about it—Mr. Noble, its originator.

The story of Mr. Noble's original idea and what has happened to it—through bureaucrats, politics, etc.—makes pretty bitter but pretty revealing reading. We think it is a major scoop.

We sincerely hope this revelation will bring some results—and thus bring about a major contribution to America's war effort.

Boiling Blood

WE READ a newspaper story the other day quoting an American airman about a dogfight he had had with Japs over northern Australia. Describing the Jap tactics, he said, "I got so mad my blood boiled!"

That flier didn't know it, but he was talking about something that may become an actual danger to American airmen—boiling blood.

The reason for it is a simple but quite fearsome fact of science. American aircraft designers will soon be turning out bombing planes capable of flight at altitudes of *more than 47,000 feet*. Major Harry G. Armstrong of Randolph Field, discussing high altitude flying recently, pointed out that if flights

Wilbert Will, of New Bremen, Ohio, built this handsome walnut trunchole desk. He started the job when he was 17 years old, and spent short periods of his spare time on the next year and a half completing it. When the job was done it was so good that it took first premium at a state exhibit. That's even more credit to him because he didn't use any power tools except in the sewing out of the parts—all the fine finishing work and the fitting was done entirely by hand. The project is built to Wilbert's original design, and it's a very attractive one. It brings him a $3.00 Workbench award and a Certificate of Merit.

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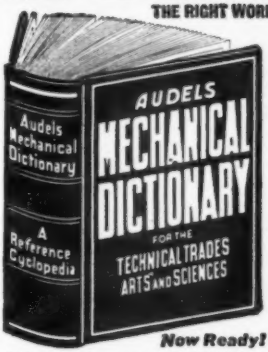

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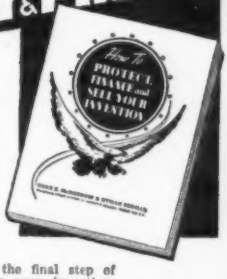

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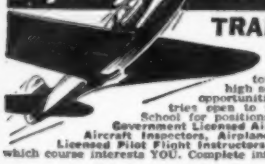

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SEE MONEYMAKERS & MONEYSAVERS (pages 27-31)

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Editor's Workbench Chips

ever go up to 63,000 feet, then the plane's pilot would be in constant danger of having his blood boil!

If a leak should develop in the pressure cabin of the airplane at 63,000 feet, the pilot's blood would boil immediately! Reason for this is that the boiling point of a fluid depends upon atmospheric pressure as well as upon temperature. Above 63,000 feet, the atmospheric pressure is so low that blood will boil at normal body temperature!

We aren't worrying particularly, though. We spend most of our time in the subway, anyhow.

MI Farm Program

SOME of you readers in the farm belt have been complaining that we don't run enough material of value to farmers in our Crafts and Hobbies section. Sooo . . . we respectfully call your attention to three specific articles in this issue, two of which could be no earthly use to anyone EXCEPT farmers. "Grasshopper Plow," on page 101 tells you how to build a very excellent contraption for fighting the long-legged pests, though we hope you won't be needing it this year. "Tap Water From Well," page 136, may well solve that problem facing many farmers of how to get running water without great expenditure. And last, but not least, "Compact

Henry Philleo, of 406 Clark St., Salesburg, Ill., built this kayak from MI plans, but he got a bit tired of paddling so he worked out some additions. The sail and outrigger are the result. Now he can glide along in pleasant leisure and comfort. The rig is so stable that the little craft can carry three people. Henry stores it under the club house at his country club, and he has a clever way of doing it. He has strung a heavy wire under the building, and placed a pulley on the wire. Now all he has to do when he puts it up for the night is to hook the top of the bow to the pulley and shove the little boat under the building—on the wire. Then he hooks the stern to the outer edge of the building floor beams, and there she hangs—suspended above the ground, and shielded from the elements by the building above. Nice work. All this brings him a $3.00 Workbench award and a Certificate of Merit.

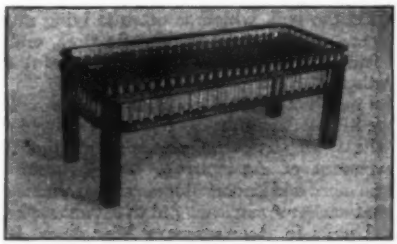
Editor's Workbench Chips

Battery Charger," page 137, is something for farmer and mechanic alike to consider . . . Now let's hear no more squawks from the Mississippi basin.

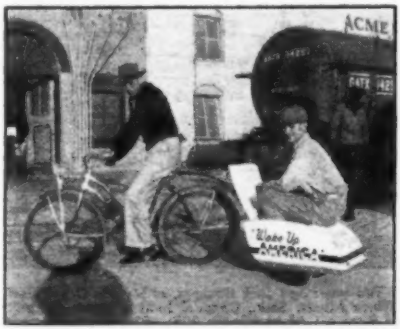
Back To The Bike—Again!

BICYCLES have been much in the news of late, first through the forced decline in the use of cars, then via the Government's order freezing the sale of new bicycles except in childrens' sizes, finally through stories and pictures of wooden, or *ersatz* bikes being developed. You'll find a photo of one such bike on page 79.

Now comes a new order from the War Production Board suspending all manufacture for civilian use of *any* article containing certain vital metals. Steel, basic ingredient of bicycles, is of course one of these metals, so it seems very unlikely that Mr. Citizen will be able to obtain any more



Frank H. Holmes, of Route No. 2, McHenry, Ill., made this beautiful inlaid coffee table. Even the intricate band of inlay work around the edge of the table top is Mr. Holmes' handiwork, and he tells us he is very fond of this type of work. A $3.00 Workbench award and a Certificate of Merit go to Mr. Holmes for this snapshot of his excellent work.



This trim little bicycle trailer was built by Roy V. Smith, Jr., Box 452, Apalachicola, Florida. The body of the trailer is contructed of waterproof plywood with rounded corners of cypress. The corner pieces were mortised by hand to take the plywood. The flat iron running gear is detachable from the body. A ½-inch pipe tongue and a ball and socket coupling attach the trailer to the bike. The strength of the trailer is apparent from the ease with which it supports its occupant in the photograph. It brings a $3.00 Workbench award and a Certificate of Merit to Mr. Smith.

They are ALL waiting for YOU

Before mechanics, carpenters, tool makers and other skilled men can go to work on new projects they must have plans made by the draftsman. Yes, drafting is tremendously important and skilled draftsmen are needed now in all lines.—Aviation, Architecture, Automotive, Diesel, Electrical, Structural, Mechanical, and many others. For any man who would like to be a draftsman there is good news, for it is a wonderful profession to learn at home. Yes, home training can make you a good draftsman, and only spare time is needed for study and practice. The price is low and the terms are easy.

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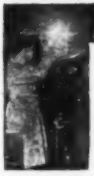

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Editor's Workbench Chips

new bikes of conventional manufacture until after the war. However, there are at present several million bicycles in use throughout the nation, and there is a good chance that a practical bike made of wood or other non-essential material will be on the scene in the near future to add to this number, thus relieving a possible shortage.

MI intends to watch closely developments in this field and keep its readers informed on the situation—possibly even present plans for a home-made bike, if a really practical one turns up. Meantime we'll continue with many hints on bike care, plus kinks and ideas for improving the old two-wheeler and making it last longer.

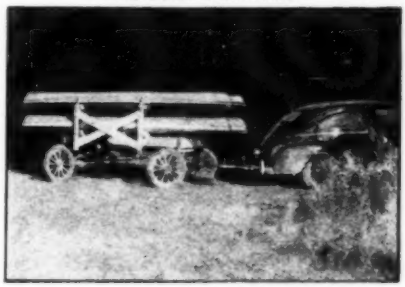
In line with this policy you'll find six pages of "bikology" starting on 114, covering everything from plans for installing a motor on your bicycle and adding a sidecar, to a nifty notion for carrying a padlock so it won't rattle around.

Treasure Chest

BOTH the nail, which so often is lying around loose, a hazard to automobile tires, and the tire itself, have become items for careful conservation.

The nail box in the farm shop and the nail can on the kitchen shelf are becoming treasure chests, say the farm structures engineers of the U. S. Department of Agriculture. They recommend that farmers and householders remind themselves of what earlier Americans did to save their hand-forged nails in Revolutionary War days. When buildings burned, a "nail party" was organized, and invited guests raked the ashes and recovered nails to straighten for reuse. During this war

HE BUILT 9 KAYAKS

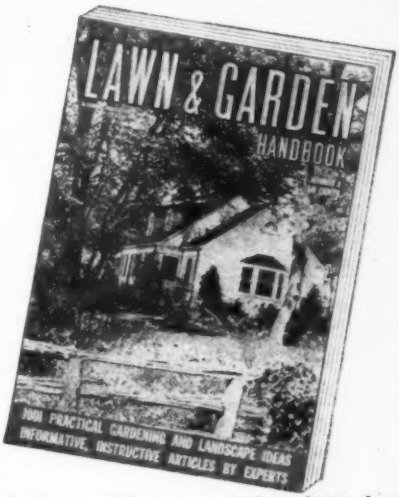


Two years ago Jack Graham, of 568 6th Street, East, Prince Albert, Sask., Canada, built a kayak. He built it from MI blueprint No. 915, which costs 50 cents. After using it a while, Jack decided he'd like to have a two-passenger job, so he changed the plans a little and went to work—building 9 kayaks.

He—or "we" as he says in his letter, added one extra frame to the kayaks, 25 inches wide. This was added at the center, and the length of the kayaks was increased from 14 feet 8 inches to 16 feet. The cockpit is now 5 feet 4 inches long, and accommodates 2 people nicely. Some of this group of 9 kayaks were made an inch deeper to give more foot room to the front passenger. The snapshot shows 4 of the kayaks on a rubber padded trailer, and brings a $3.00 Workbench award and a Certificate of Merit to Mr. Graham.

WAR GARDENS ARE PRACTICAL AND ECONOMICAL

ENLIST in the Victory Garden program this Summer! You can aid the nation's war effort and also economize on your own household expenses by getting the down-to-earth facts on war gardens in the new edition of LAWN & GARDEN HANDBOOK, just out. This handy and instructive book features a complete summary on Victory Gardens by H. W. Hochbaum of the United States Department of Agriculture.



In addition, LAWN & GARDEN HANDBOOK contains many other articles of great value and interest to the amateur gardener. The 146 pages of this handsome book are packed with information and pictures on such useful subjects as: how to obtain a good lawn, planting seed flats, the children's own garden, chrysanthemums for Fall beauty, designs for brick and stone walks, flower arrangement, and dozens of related topics.

LAWN & GARDEN HANDBOOK will save you money in making a landscape plan for your home. This book offers four basic garden plans drawn especially by an expert for this publication. Ordinarily one such plan would cost as much as $100—but you get *four* of them in this 50 cent book! Get your copy today at your newsstand, or order by mail with the coupon below.

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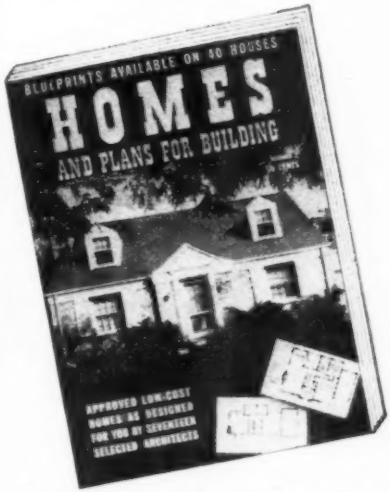
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Editor's Workbench Chips

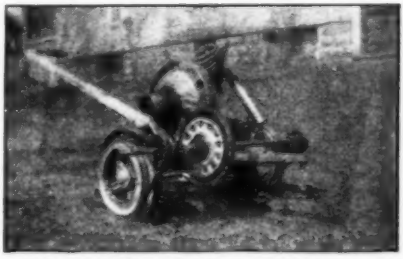
iron will be needed for fighting equipment and the nail again becomes an item in the defense of the country. So, the Bureau of Agricultural Chemistry and Engineering says, "recover all nails, straighten them, and stir them in a little oil to stop rusting." Do not forget the bolts and screws, either.

Army Camera Fans

CAMERA fans among MI readers, and that includes almost all of you, we know, don't have to resign themselves to the belief that entrance into military service means giving up their hobby for the duration. Didn't you know that many USO clubhouses have darkrooms, and supply material—without charge!—for film development, printing, and enlargements?

Yep. Furthermore, the USO's program department has organized photographic units in clubhouses, and scheduled "Snapshot Dances" where candid cameramen's unusual pictures are

This model Taylorcraft has never flown because it has only a dummy motor. Ian McLead built it as a detailed model for appearance instead of flight. Ian is 14 years old and lives at 11003-87 Ave., Edmonton, Alberta, Canada. He says that it was so windy when this picture was taken that one of the stabilizers blew off the model. It was still a complete and very neat job, however, when this photo was snapped, so it brings him a $3.00 Workbench award and a Certificate of Merit.



William T. Paul, of 109 S. River St., Geneva, Ill., built this simple and efficient gasoline lawn mower. It's economical in operation and it does a fine job on the grass. A $3.00 Workbench award and a Certificate of Merit to Mr. Paul for this snapshot.

Editor's Workbench Chips

awarded prizes. (Predominant subject: Girls!)

As you'd suspect from your own choice of subjects at home, most pictures made by amateur photographers in uniform are shots of themselves or their buddies in military poses, or relaxing off-duty. Until banned, photos made from atop the Empire State building by service men on leave in New York City led all others in those developed on USO premises.

Much of the work, though perhaps turned out under conditions less easy and convenient than those of your darkroom at home, is of such high quality that it is displayed on bulletin and exhibit boards of military gathering-places all over the country. Some is so outstanding that the photos have been gathering checks from national publications and been entered in numerous contests.

Thus, photographers of the caliber of you followers of MI's camera department and PHOTOGRAPHY HANDBOOK and GOOD PHOTOGRAPHY magazines are not only able and encouraged to enjoy your interesting and relaxing hobby after you get into service, but are in a splendid position to contribute to the picture record of America's mighty and far-flung war effort in a way that will be increasingly appreciated and valued in the years to come.

Tin Can

WHILE the nation's by-word nowadays is "save the tin cans," so that the metal of empty containers can be salvaged, some tin cans can be given secondary use at home of such value as to equal their contribution to scrap metal piles.

Harold Ratcliffe of Smith County, Nebraska, gets full use of his old quart-size oil cans. Like MI Workshoppers turning their ingenuity to smart

[*Continued on page 31*]

Roy Alson, of P. O. Box 276, Kingsburg, California, built this bike from three sizes of pipe and a few old bike parts. It's very easy-riding due to the springy frame. Roy tells us that he was very interested in MI's "Back to the Bike" article, and it isn't hard to see why he would be. With bikes at a premium these days, it's nice to know you can build your own—if you know how. A $3.00 Workbench award and a Certificate of Merit go to Roy for this snapshot of his sleek looking bike.

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MAGICIANS, GAMBLERS' Secrets Exposed 25c. Catalog Magic, Occult, Books, Cards; Novelties, Samples 10c. Easternecity Sales, 32-WE1 Randolph, Chicago.

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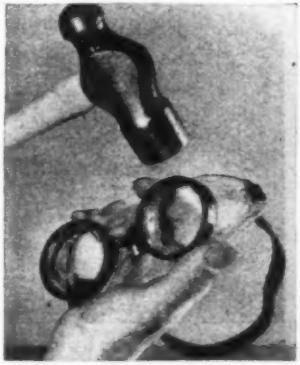
Shatterproof Goggles Resist Hot Sparks, and Increase Vision



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SONGWRITERS! AMAZING, convincing offer. Hibbeler, C32, 2157 No. Avers, Chicago.

WANTED ORIGINAL Song Poems. Five Star Music Masters, 629 Beacon Building, Boston.

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1942 35MM HIT! 36 exp. rolls, fine grain, enlarged 2¼x2¼ glossy (except Univex) 85c; 18 exp. 55c. Include postage with remittance. "Studio 35," Box 677, Grand Central P.O., New York City.

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BULK MOVIE film—8-16mm. Big savings. Fine grain, non-halation. Plans for building movie processing outfit with all formulae, 25c. Also bargains in accessories. Write for free circulars and film sample. Superior, Dept. F-7, 188 W. Randolph, Chicago.

Chemical Powder Dries Out Damp Rooms

Basement workshops, photo darkrooms, closets, vaults, laundry rooms, can be kept free of damp and musty air with an inexpensive chemical powder now being marketed. Placed in a one-piece, triple-V-shaped basket, 10 lbs. of the powder, being exposed to air on all sides, absorb excess moisture from the air, then continue to function by removing dampness as fast as it occurs. One container is recommended by the makers for each 800 to 1,000 cu. ft. of space. Drippings from the basket are valuable and can be saved for melting ice on slippery sidewalks, eaves, and waterpipes; or for settling dust in gravel driveways and for killing weeds.

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SAVE 50% ON movies. Bargain circulars. Genera Company, Davenport, Iowa.

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AUTO OWNERS: My $1.00 Diagram shows how to operate auto on Cheap Kerosene. M. E. Lipscomb, 300 S. Burlingame, West Los Angeles, California.

R & R Mfg. Co., Box 546, Anderson, Indiana. Speed Equipment for Racing Cars, Boats and Midgets, Catalogue 25c. Fuel Data 75c. Instructions $1.00.

AUTO SUPPLIES & EQUIPMENT

CONVERT YOUR car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 5A. Harrington Company, 201-204 Manchester Building, Portland, Oregon.

NEON V for Victory installed on Car. No Transformers. Takes no current from the Battery. $5.00 Complete. Pontiac Neon Mfg., 51 N. Parke, Pontiac, Michigan.

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Autoists Can Brand Car Tires Protectingly

Steers and horses are commonly branded with their owner's mark to identify them easily and protect them from theft. The idea now has been adapted by car-owners whose tires are as precious, and in as much need of protection from thieves, as the aforementioned critters ever were. The young woman in the photograph above is pointing to a newly-branded tire, the brand having been added to the tire by use of an inexpensive, new marking kit just put on sale. Gummed stencil letters and figures are arranged on the tire wall's surface and daubed with a fluid which eats into the rubber far enough to leave a permanent identification. Both inside and outside of the tire are branded to foil thieves who plan to show only the unmarked side to view.

FUEL, OIL Conversions for Automotive, Marine engines, write for free literature. Houston & Logan Conversions, 2112 Addison, Berkeley, California.

TIRES BAD? Repair your own. Inexpensive, no equipment, instructions 50c. Irving, B367, Haverhill, Massachusetts.

TIRES, ANYONE can rebuild. Fraction retreading cost. Stamp please. Box 1081X, Bismarck, North Dakota.

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MOTORCYCLES, RECONDITIONED, New, used, parts and accessories. All makes. Large stock. Bargains. Illustrated catalog, 15c. Indian Motorcycle Sales, Kansas City, Missouri.

BUILD ELECTRIC power bicycle, low cost, easily built, operate cheaply, practical. Detailed plans 50 cents. Leland Hoke, 312 Market Street, Watertown, Wisconsin.

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BRINKS' BARGAIN Bulletin: New—used machines, motors, tools for all shops. Brinkerhoff, 36 Walker St., New York City.

RECLAIM DULL and broken drills with Nu-Way Drill Grinder. Circular Free. Tractor-Lite Mfg. Co., Sidney, Iowa.

GRIND DRILLS like factory: attachment for bench grinder. Cheap. Factory, 811-C East 31, Kansas City, Missouri.

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INVENTORS:—HAVE you a useful, non-military invention for sale? Practical new ideas, patented or unpatented, urgently needed by manufacturers and consumers. Write for details. Chartered Institute of American Inventors, Dept. 5-B, Washington, D. C.

INVENTORS! SELL your invention yourself! Write: Crompton, 99-I Owen, Detroit, Michigan.

GET YOUR own patents. Blanks, Instructions $1. Cudding Sons, Campbell, California.

CASH FOR practical ideas and inventions. Mr. Ball, FA-9441 Pleasant, Chicago.

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INVENTORS:—FORESIGHTED manufacturers already planning post-war sale of new non-military products. If you have a useful invention, patented or unpatented, write Chartered Institute of American Inventors, Dept. 5-A, Washington, D. C.

INVENTIONS PROMOTED. Patented or Unpatented. Write Adam Fisher Co., 582 Enright, St. Louis, Missouri.

PATENT ATTORNEYS

INVENTORS—PROTECT your idea with a Patent. Secure "Patent Guide"—Free. No charge for preliminary information. Write Clarence A. O'Brien and Harvey Jacobson, Registered Patent Attorneys, 2-B-G Adams Building, Washington, D. C.

"INVENTOR'S GUIDEBOOK" containing 96 mechanical movements and advice about patenting, selling inventions, also "Record of Invention", Free. Frank A. Lederman, Registered Patent Attorney, 154 Nassau Street, New York.

INVENTIONS WANTED

INVENTORS:—SMALL manufacturers need new inventions for altered civilian markets. If you have a practical, useful idea for sale, write Chartered Institute of American Inventors, Dept. 5-C, Washington, D. C.

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MODEL ENGINES

NEW MODEL Airplane Motors $3.35 each. Particulars, stamp. Ace, 1017-MI North McBride, Syracuse, New York.

LATEST ENGINE Catalog 25c. Refunded. Howardeo., M-2417 North Ashland, Chicago.

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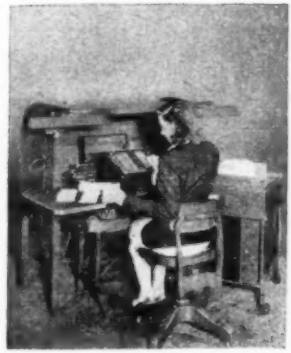

The punch and clatter of bookkeeping machines can be prevented from disturbing the work of the rest of the office with a new three-sided booth-like device on legs which can be pulled over the main part of the machine. The booth deadens the sound so that the operator practically occupies a private office—yet is instantly available to fellow-workers. Besides this advantage, the "private office" does not take as much space or expense as creating a small, separate room would require. An adjustable-arm lamp is attached to the booth and two fluorescent lights are built-in so that superior illumination can be given the operator's work shelf without glare. There is also a ventilating fan.

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BUILD YOUR tractor from second-hand automobiles! Convert your horse drawn farm equipment into tractor drawn equipment. Nolan's Garage, East Wareham, Massachusetts.

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DEFENSE WORKERS, mechanics, etc., use Emul-soap the new, odorless liquid soap that dissolves grease, removing it instantly from hands. Also antiseptic, preventing infection, healing cuts. Be economical, use Emul-soap. Rush 35c (coin only). Box 1916, Boston, Massachusetts.

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ENJOY ALL the thrills of fishing and sailing in your own beautiful 18-ft. Cabin Auxiliary Sloop. Easy to build if you follow instructions. Complete plans, diagrams and instructions, only 25c. Specify Booklet 1. Write today to How-To-Build-It Editor, Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Connecticut.

U-MAK-IT BOATS—Easy-to-Build, Kayaks, Rowboats, Dinghies, Outboards, Inboards, Sailboats, Runabout for auto engines. Over 300 in stock. Complete kits. Simple to assemble. Send 10c (coin) for all catalogs with illustrated construction details. Largest selection offered. Kayak Boat Co., 152A-East 129th St., New York City.

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OUTBOARD MOTORS—used and rebuilt bargains, list free. Used parts, save money. Crandall-Hicks Co., 953 Commonwealth, Boston, Massachusetts.

FORD AND Zephyr marine conversions. 10c coin. Lehman Engineering Company, Dept. C, Newark, New Jersey.

OUTBOARD MOTORS, used parts. Outboard Exchange, 1194 Remsen Ave., Brooklyn, New York.

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FLYTYER—"ABC" chart method teaches you quickly. Two dimes. Satisfaction. Fishcrafters, Box 804M, Worcester, Massachusetts.

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ROME TACKLE for finest archery equipment. Catalogue 3c. Box 166, Rome, New York.

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LENSES—BUILD your own telescope, field glass, microscope, riflescope, etc. Assortment of fifteen lenses—$1.00 postpaid. Slightly chipped on edge. Satisfaction absolutely guaranteed. American Lens Company, 324 North Mayfield, Chicago.

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TESTAID (INTESTINAL Aid) for clever, intelligent, busy people. $1.00 postpaid. Address Testaid, 18240 Lasher, Detroit.

ATTRACT SUCCESS, confidence, happiness, health, through secret mind power. Particulars Free. Ontology, Sedalia, Missouri.

CONQUER ALL Illegal coin machines! Particulars, 3c stamp. Devereaux, Box 212-W, Battle Creek, Michigan.

MEXICAN LEGAL Matters. Wm. Cocke, Reliable American Attorney, El Paso, Texas.

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MONUMENTS—DIRECT Low Prices. Freight Paid. Lettered. Guaranteed. Free Catalog and samples. Write Granite-Marble Factory, Alf, Oneco, Florida.

OLD GOLD WANTED

GUARANTEED HIGHEST prices; Surprise Gift. Mail any jewelry, teeth, watches, rings, eyeglass frames, diamonds. Reliable company. Free information. Consolidated-Ward, Box 819, Dept. L-2, Chicago.

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WATCHMAKERS' MATERIALS. Tools, Jewelry—bought, sold. Best prices for Old Gold, Diamonds. Free Catalog. Ben Segal Company, Box 150, Chicago.

ELGIN, WALTHAM Watches $3.50. Make big money. Free watch and jewelry catalog. Plymouth Jewelry Co., 163-C Canal St., New York.

MISCELLANEOUS

SAVE WEAR and tear on your car. Shop by mail. These guaranteed advertisers will supply your needs satisfactorily.

75 DOUBLE EDGE razor blades postpaid for dollar bill. Howard Co., P.O. Box 336, Libertyville, Illinois.

MAGIC SHORTHAND Typewriting Course. Sensational 25c. Jones, 1210M Dudley, Utica, New York.

BURIED TREASURE, Minerals, free booklet, photographs. Fisher Laboratory, Palo Alto, California.

MORE BUYERS for your money. Write to Bill Correll, 23rd Floor, 1501 Broadway, New York City.

LUMINOUS PAINT—new brilliant ⅝ oz. bottle 25c. Fabiano Chemical, Elberon, New Jersey.

DIVING HELMETS, Pumps. Reasonable. James Monroe, Box 333, Middletown, Ohio.

WANTED—MISCELLANEOUS

CASH! GOLD, jewelry, teeth, coins, diamonds, mercury, etc. Ship! Simon's, 353 Old Arcade, Cleveland, Ohio.

BEGINNING WITH THIS ISSUE
ALL MECHANIX ILLUSTRATED CLASSIFIED ADS ARE GUARANTEED

Editor's Workbench Chips

[*Continued from page 25*]

war-time short-cuts and economies with materials, Mr. Ratcliffe used the cans to sub-irrigate his garden, to get better quality vegetables during the summer, and a supply of canned goods for a balanced diet in winter.

To subirrigate he cut out the tops and bottoms of the oil cans and buried the cans like clay tiles in rows about 3 feet apart and about 8 inches below the surface. He planted his vegetables in rows close together to shade the ground as much as possible and to keep down the growth of weeds.

In repayment for this underground work, his garden—40 by 60 feet—netted the family more than $50 worth of foods for canning, during the dry summer of 1940. Planning his Victory garden last spring, Ratcliffe buried more cans and placed them closer together. He also enlarged the size of his garden plot and is due to get a bumper crop in '42.

While you who have good soil, room, and time for a Victory garden have long since completed the planting, Mr. Ratcliffe's idea is one you may be able to adapt even yet. It's these little smart tricks for increasing production that mean a lot nowadays. Probably you have thought up and applied many original ones successfully yourself. Let us hear about them! We'll pass all the good ones along to other MI readers. We and they'll be all-fired grateful.

Robert Macloud, of 1847 Religious Street, New Orleans, La., built this 11-foot motor launch from MI plans. "The plans were so clear that it was a snap building it—" he writes. He also built the trailer upon which the boat is shown in the photo. A 1½ horsepower Briggs and Stratton engine drives her, Bob says and she handles nicely. He also tells us that he can't see how the boat's going to get much rest, because she's going to be used for fishing in the daytime and for swimming when the fishing's done. Mr. Macloud did a nice job on this little boat, and for his snapshot he gets a $3.00 Workbench award and a Certificate of Merit.

THRILLING!

THE GREATEST STORY OF THE WAR

INSPIRING!

HERE is the most thrilling and inspiring story of the day! MACARTHUR, HERO OF DESTINY packs within the covers of one book the complete life story and more than 80 excellent photographs covering the amazing career of America's greatest military leader. This story, though strictly factual, is more thrilling than any adventure story and more inspiring than a dozen editorials on patriotism. All the highlights of Gen. MacArthur's spectacular personal history, from boyhood to the present day, are thoroughly covered. MACARTHUR, HERO OF DESTINY is on sale at your newsstand. Or you can order by mail, using the coupon below. Only 25 cents.

CUT OUT AND MAIL TODAY!

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Greenwich, Conn.

Gen. MacArthur is my hero, too. Enclosed find 25 cents in cash, money order, check, or stamps for one copy of MACARTHUR, HERO OF DESTINY. Send it to me postpaid.

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(CANADIAN ORDERS NOT ACCEPTED)

Letters To The Editor

To the Editor:

Here comes a contest entry from a mining camp in the mountains of east central Arizona, a spot so far removed from the hustle and bustle of city life that mail is brought into camp by Pony Express rider—to our knowledge, the only place in the United States that is still served by Pony Express.

Raymond Loomis
Sombrero Butte, Arizona

Unfortunately, Reader Loomis didn't win the airplane.—Ed.

• • •

To the Editor:

I have a wheel chair with no identification marks on it, and it has been only with the greatest difficulty and delay that I've ever been able to get parts for it. With the priorities and shortages now in effect, it is next to impossible to get anything but promises.

I've always noticed how MECHANIX ILLUSTRATED readers seemed like a large family with mutual interests and good will and wondered if I might ask a favor. I would like to get in touch with any company or individual who might be willing to make a couple of 7-inch wheels for me, or if not that, repair a couple that daily threaten to "let me down." MI seemed the logical place to ask this favor.

Chester L. Marks
413 West Green St.
Ithaca, New York

• • •

To the Editor:

I note in your May issue that you have been receiving numerous letters in regard to the "Lost Dutchman Mine" in Arizona, described in your February issue.

I am considering organizing an expedition to make a search for this mine, which will last for an entire year, if necessary. Inasmuch as there are so many interested in an expedition, I believe it would be better to combine into one expedition and make the search for at least a year. In this length of time every square foot could be covered over several square miles, and the chances for success would be much better.

I would like to hear from anyone interested.

H. M. Tucker
404 Hassett Avenue
Fort Worth, Texas

• • •

To the Editor:

I read an article published in your May issue, which astounded me. It dealt with the famous—or infamous—legend of the "Lost Dutchman's Mine."

I am a mining man, therefore I am NOT going to say there is no gold in the "Superstitions." *There could be.* But I have lived in this part of Arizona most of my forty years, and I have never seen, heard of, nor talked to anyone who ever found any there—and the searchers have been numerous, including the man who in 1925 staggered into Phoenix, thirsty, footsore and exhausted, with a lurid tale of finally having found the "Lost Dutchman Mine." To prove it he had a tobacco can full of nuggets. After tying up the entire sheriff's force for several days, with resultant publicity, the gold was discovered to be melted dental gold.

Tell these would-be prospectors, who probably have never seen gold except in jewelry, to stay home, work, and buy U. S. Bonds with that money, instead of wasting it on an expedition. There may be a "Lost Dutchman Mine" but scores of the toughest, wisest, desert-trained prospectors in Arizona have hunted for it down through the years, and it still remains—lost.

E. M. Cross
Superior, Arizona

• • •

To the Editor:

I have built your Torpedo Boat and have found it to be an excellent model for boat builders. The total cost, excluding the propeller assembly, was only $1.50.

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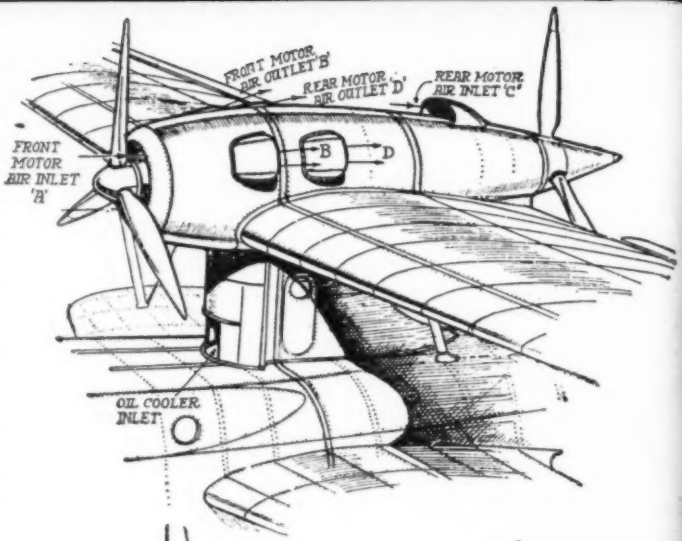
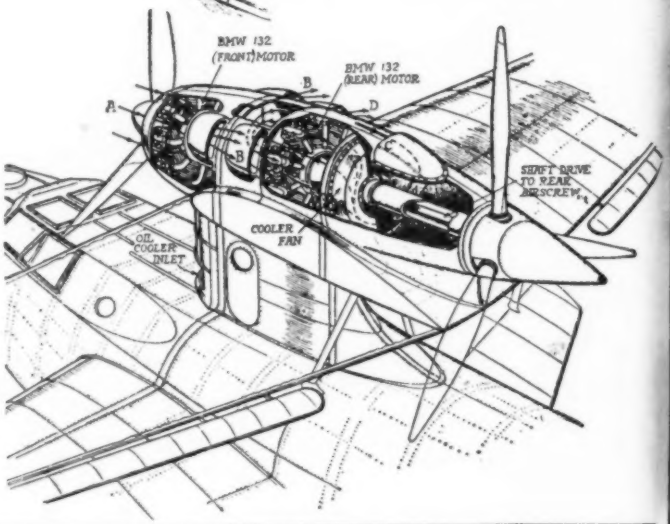
DORNIER DOES AN ODD JOB

THE twin-motored Dornier Do 18K2 presents an unusual engine arrangement. Although the forward engine is cooled in conventional manner, air for the rear engine is drawn in through a duct above and behind the engine, then drawn forward by a fan, driven through the cooling fins of the motor, and released backwards along the sides of the nacelle. The engines are each 865 horsepower, the rear one driving its propeller through a shaft. Note the arrangement of inlet and outlet cooling ducts. This is a Nazi plane.



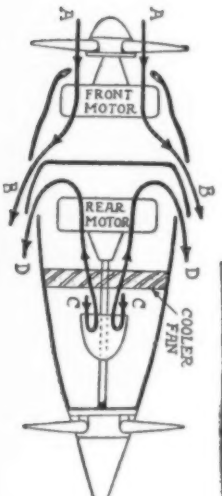


A.—COOLING AIR INLET TO FRONT MOTOR.

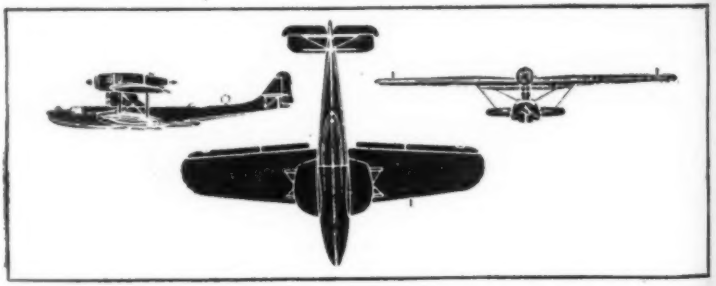
B.—COOLING AIR OUTLET FROM FRONT MOTOR.

C.—COOLING AIR INLET TO REAR MOTOR.

D.—COOLING AIR OUTLET FROM REAR MOTOR.



TOP VIEW OF NACELLE.



BOMBARDIER

Fly on a raid with an RAF air observer, highly-trained key man of every bomber crew!

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RECEIVED

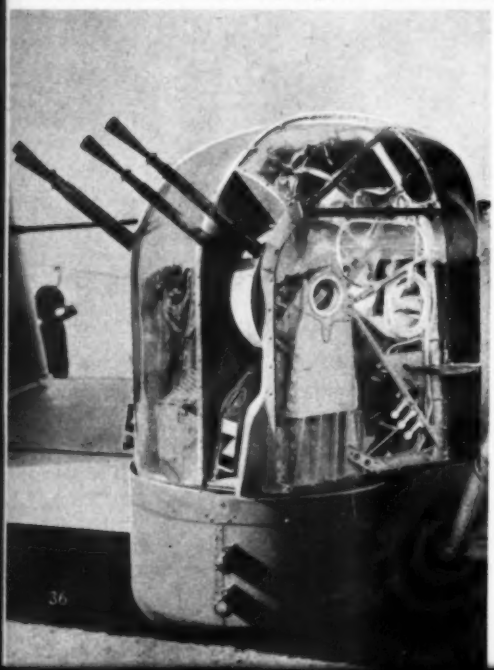
Near targets, the AO *(inset)* in each bomber in the raid formation peers through the sight, finger ready on the bomb-release.

by Flying Officer John L. Scherer

Royal Canadian Air Force

"SOMEWHERE in England" a huge bomber is being loaded with fuel and bombs. It is one of a dozen scheduled for a night raid on an industrial town in Naziland. Mechanics swarm over the planes, filling the empty tanks with gasoline and oil for the powerful motors. Armorers climb aboard with ammunition for the machine guns that protrude from the numerous turrets bulging from the fuselage sides, bottom and top. They don't overlook the tail turret with its four guns—a real stinger for a man-made wasp. Carts

Equipped with parachute, life-preserver, and inter-communication set, and bundled against altitude cold, co-pilot and pilot watch for enemy interceptor planes. *(Below)* Whitley bomber's tail gun-turret, deadly stinger of a man-made wasp!



are wheeled out toward the bombers, each carrying a 500-pound bomb to be loaded aboard the planes. Only six bombs to a plane because of the heavy fuel load—for the objective is far away and it is a two-way trip if the fates are kind.

The motors bark to life while the mechanics scan numerous tiny dials on the illuminated instrument boards in the cockpits, warming up the engines to the point of smooth operation. Inside an office in one of the hangars, the bomber crews crowd around a table. A Group Captain is pointing his finger at a spot on a map similar to the maps on which the bomber's air observers have previously plotted the course to the "target for tonight."

"There's your objective, men. You have your orders and have plotted your courses. Your aircraft are almost ready. Good luck!" The floorboards echo to scuffling feet as the officers and men rush out of the room and head for their respective aircraft. The night's work has started!

The AO-bombardier whom we'll accompany has climbed aboard his plane and made his way to the plotting table located

The Short-Stirling bomber can carry a greater weight of bombs than any other in operational service. The destructive "Bundles from Britain" being loaded by the squad above were trundled planewards by a tractor *(below)*. Maximum bomb load is six.

just aft of the pilot's cabin. He makes a last-minute check—maps, protractors, slide rules, pencils, pads, computer, etc. All are in place, ready at hand.

"Up front" the pilot plugs in his interphone and checks with each crew member—"Navigator, all set?" The answer comes back promptly—"Navigator here, sir. Everything tip-top." In a few minutes the pilot has checked with each gunner in the tail, belly, nose, and side fuselage positions. All are in position and ready to go. So, upon receiving a "take position" flash from the operations hut, he taxies his huge bomber into takeoff position.

While waiting for the other planes to assume position, the pilot runs through his cockpit check—H-hydraulics (landing gear), T-trim (stabilizer), M-mixture (full rich carburetor for takeoff), P-pitch (propeller angle, full fine for takeoff), F-flaps (up for takeoff), G-gas, C-carburetor heat (full cold for takeoff). The co-pilot mumbles the letters H, T, M, P, F, C, G—and double checks the pilot as he runs through the cockpit check. All is in order and the planes are lined up for takeoff. A signal—and with a mighty roar from powerful engines the aircraft rumble down the runway and into the air. The raid is on!

Our AO is nervous and he'd be the first to admit it. Of course, he has done all this

before in practice, but THIS is the REAL thing! Doubts assail him. Did he plot the course correctly? Is the mileage correct? But then he recalls that he checked his calculations with some of the old-timers before the flight, and his confidence returns. He speaks to the pilot over the inter-communication phone, giving him the course for the first leg of the flight.

The aircraft climbs steadily to 12,000 feet. At regular intervals the pilot inter-phones the gunners. He jokes with each for he knows how tense they are—staring into the black sky for signs of attacking enemy planes. After checking with the tail gunner he turns to the co-pilot, "You know, that tail gunner is like a WOW bird. He can't see where he's going, only where he's been."

The bombers drone on through the night sky. They are well over enemy territory now and anything can happen. ANYTHING. And it does—bandits are sighted at left overhead.

The sergeant gunner climbs into the tail turret. His guns pick off rear attackers.

The port gunner inter-phones, "Enemy planes, sir. I can see the flames of their exhausts. They seem to be pacing us."

The pilot warns each gunner to prepare for an attack. Then he heads for a layer of clouds below, to conceal his aircraft in the billowy mass before the enemy fighters open fire. Sensing his intent, the enemy forces the issue. They dive for attack.

The tail gunner is first to fire as the enemy come within range, but the other gunners are busy, too. A dark shape goes by the bomber, exhausts flaming as it pulls up and away. The belly gunner reports he thinks he "got one of the b————, sir!" The tail gunner reports that the bombers in the rear have broken formation and have dived into the cloud layer.

In a few seconds the lead plane is also within the cloud layer. The pilot knows the fighters will not fly—blind—into the clouds because of the danger of colliding with the bombers, and hopes the layer will extend far enough to enable the bombers to shake off the pursuit. (Fighters can remain aloft for only 1½ to 2 hours from time of takeoff.)

Cautioning the co-pilot to watch the carburetor heat to prevent carburetor icing while in the clouds, the pilot calls the AO on the inter-phone: "Change course yet?" The AO quickly checks his calculations and answers—"Not yet, sir. Keep present heading for seven minutes."

In due time the AO calls the pilot and gives him the heading that will lead them to the objective. The plane drones on. A half hour later it breaks out of the clouds and the AO checks position. He is elated to find the plane dead on course. The gunners scan the sky but cannot see any enemy planes nor the companion bomber aircraft.

The AO is a busy man now. Check and double check. He figures they should be over the target in 15 minutes [*Continued on page* 161]

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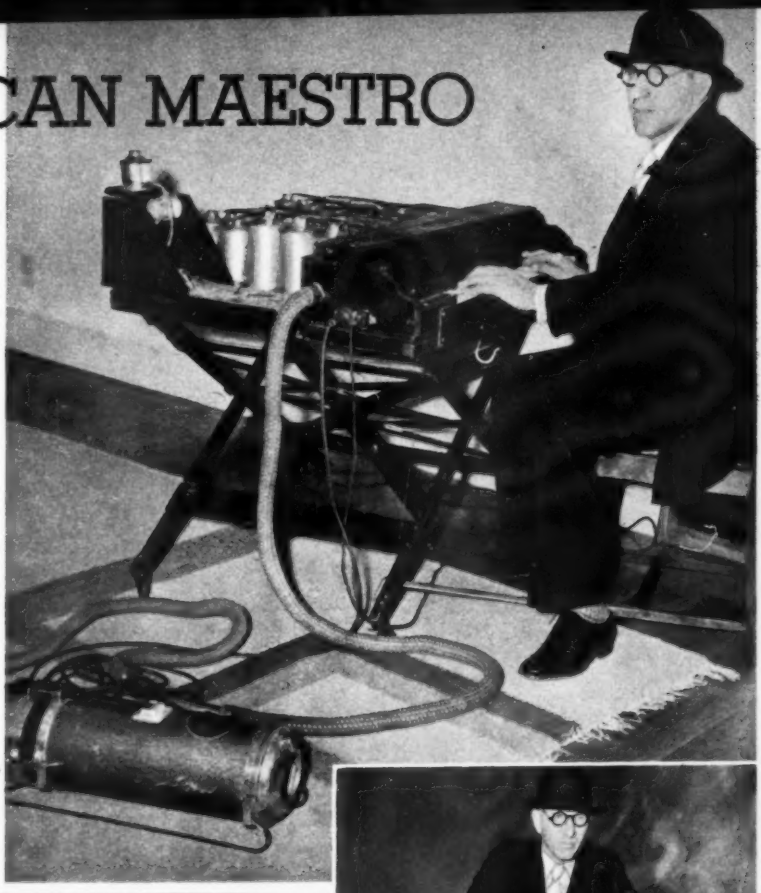
TIN CAN MAESTRO



It was cold in the house the day the maestro posed with his beer can calliope whistled by a vacuum cleaner. Under full pressure (below, right) it offers visual as well as highly audible entertainment.

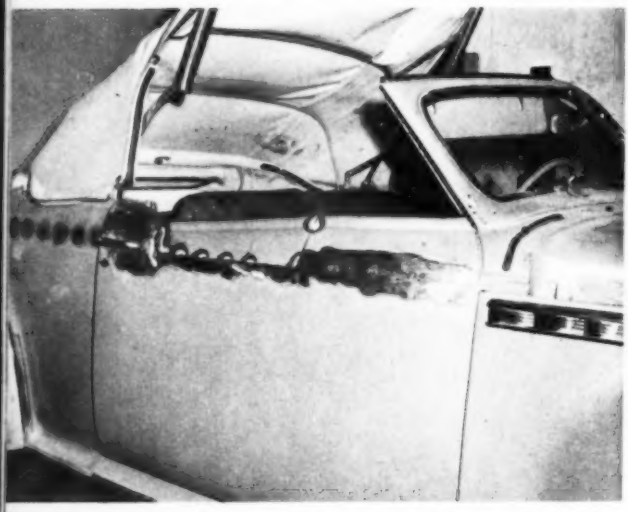
(*Below*) The shy smile is one of pride—the tin can Kostelanetz not only made the assembled guitars, ukelele, and mandolin himself but, a true virtuoso, he performs on them unassisted.

GIVE an old tin can to W. H. Phillips of Sacramento, Calif., once a musically-frustrated truck-driver, now just a truck-driver, and he'll probably convert it, Lord help you, into a mandolin, guitar, or calliope, whichever you require. He spent five years perfecting the calliope shown here. Admirers, among whom are said to be camp show audiences for which the hard-hatted minstrel plays by ear, say the music is first-class, too.

Howard Darrin, right, sizes up glamour possibilities while a helper starts reworking the top.

Even Hollywood's Cars Are Glamourized

Movie folk demand heightened beauty and advanced styling even for their automobiles! They go to specialist Howard Darrin.

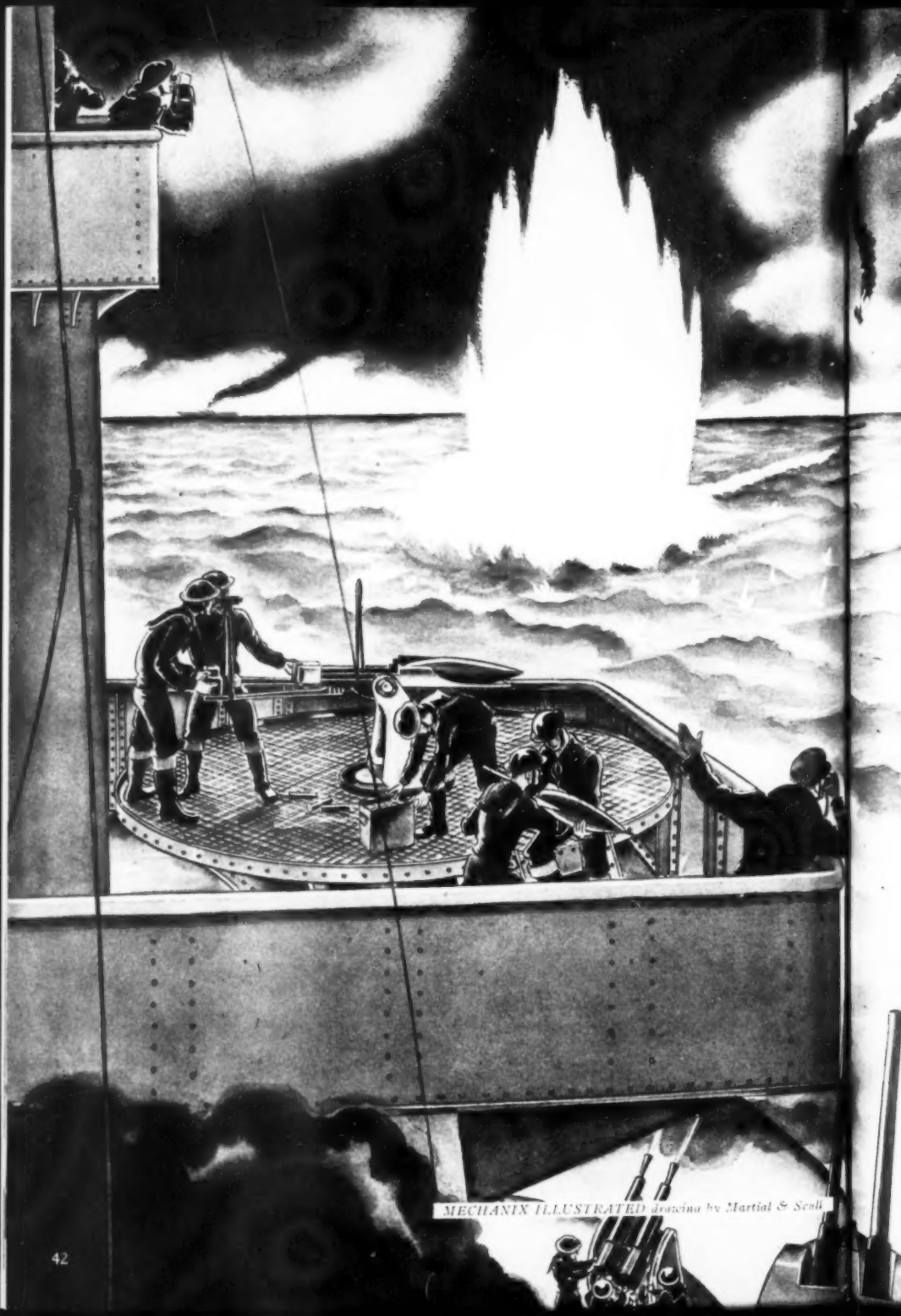


SUSIE SWEET may have been lovely enough for the folks to name her Miss Home State 1942 and put her on a Hollywood train so that all the world could know her beauty, but the lily-gilders there don't consider her worthy of movie film until she's been glamourized. That's the term for a cosmetic-coiffing-lacquering ordeal for Susie with results that worry Hedy Lamarr and delight sweater makers—although it's still the Sweet chassis underneath.

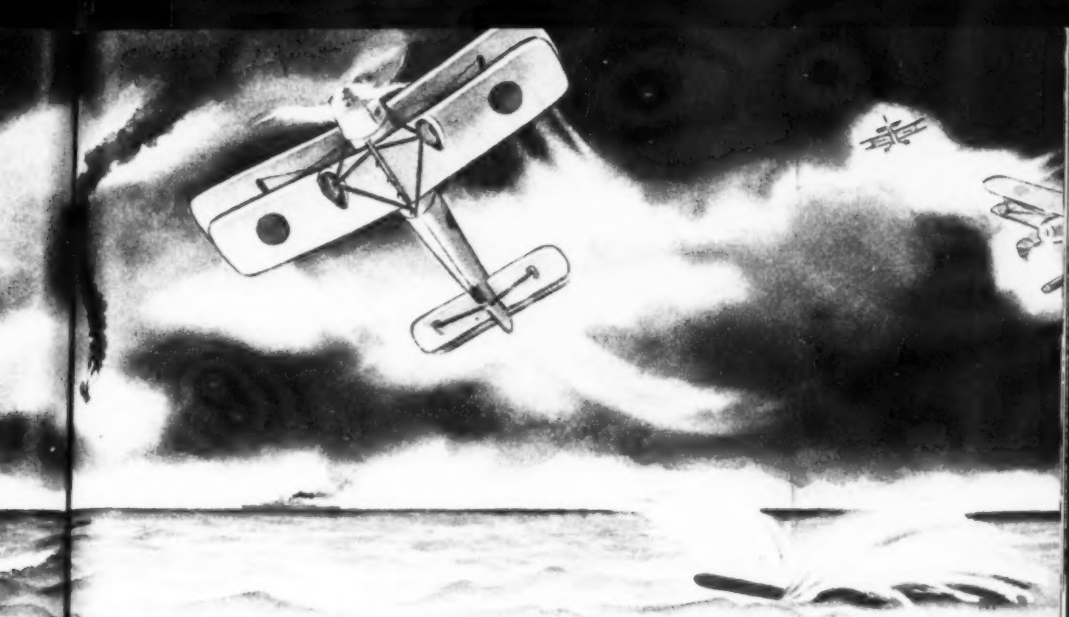
A new high-powered car affects the upper-income Hollywood mind the same way as pre-glamour [*Continued on page* 177]

Slanting the top of a Buick door gives it the rakish lines movie folk gladly pay for.

M-G-M actress
Inez Cooper relaxes
in the lever-operated couch-seat
Darrin installed for her boy-friend,
M-G-M player Bill Marshall, left, owner of the
car. Below, he's proudly taking possession.



MECHANIX ILLUSTRATED drawing by Martial & Senli



A Torpedo-Destroying Gun

MECHANIX ILLUSTRATED offers a possible solution to the Nazi menace of underwater attacks.

MECHANIX ILLUSTRATED presents herewith what it believes may well be the answer to Germany's vicious torpedo attack on our Atlantic shipping —a gun specially designed to destroy torpedoes.

It is simple. Actually, it is a refinement of an ordinary whaling harpoon.

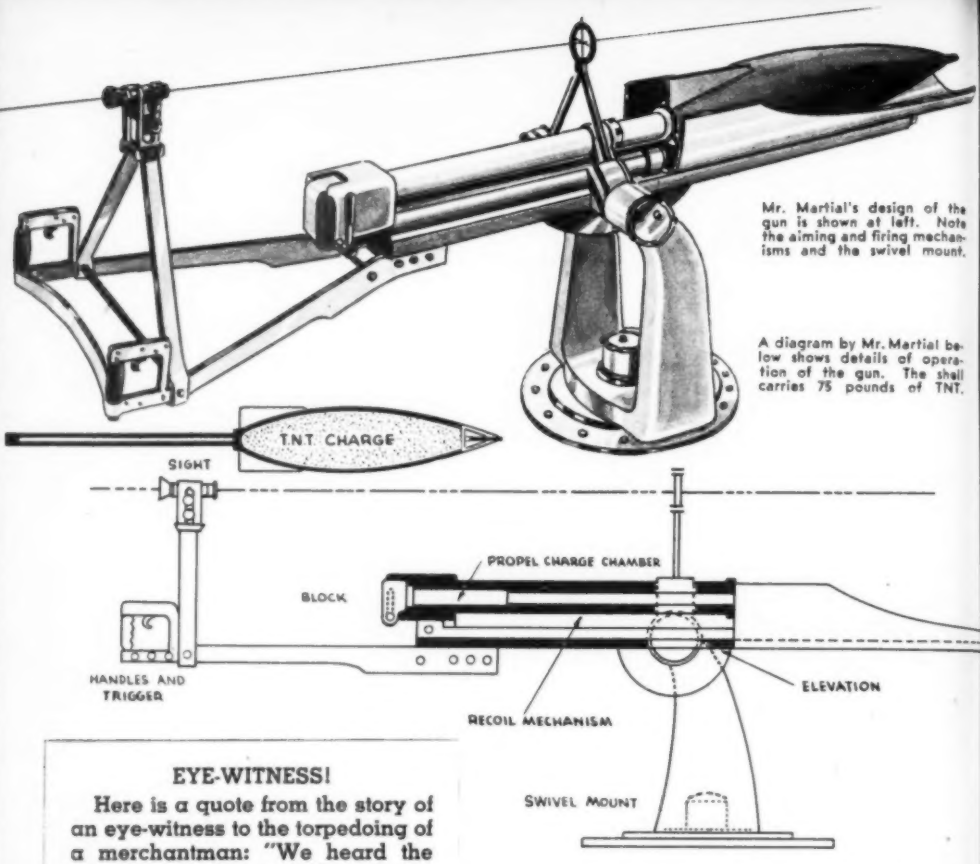
It takes advantage of what apparently is the torpedo's only great weakness, which is this fact: A torpedo, after it is launched by a U-boat or a plane, runs at a speed of only 36 miles an hour and leaves a visible wake.

Many U-boat victims, relating their eye-witness stories of torpedo attacks, have told of standing on deck and watching the wake of the torpedo coming toward them. Cecil Brown, famed CBS radio reporter, said in broadcasting his description of the sinking of the British battleship, *Repulse*:

"There is a deadly fascination in watching the torpedo streak toward us."

Several weapons experts have suggested that ordinary deck guns could be limbered in such a manner that they could fire upon approaching torpedoes. How-

A high explosive harpoon gun swings into attack in the imaginative drawing above. It has just smashed a submarine's torpedo (upper left) and now is about to shoot a plane's missile.



Mr. Martial's design of the gun is shown at left. Note the aiming and firing mechanisms and the swivel mount.

A diagram by Mr. Martial below shows details of operation of the gun. The shell carries 75 pounds of TNT.

EYE-WITNESS!

Here is a quote from the story of an eye-witness to the torpedoing of a merchantman: "We heard the watch yell, 'Torpedo!' and we rushed to the port side and looked out to sea. There was a nasty white wake bearing down upon us. I know it was coming fast as an automobile, but it seemed that it would never reach us. We all stared at it, fascinated, wishing to God we could do something, but helpless to do a thing."

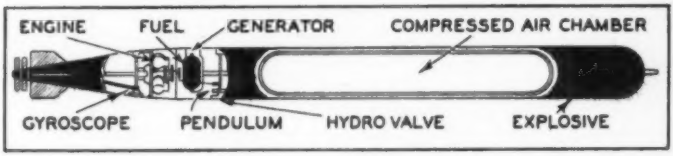
ever, the fallacy of this idea is that torpedoes ordinarily are set to run at from 10 to 18 feet under water and gunfire is not effective at a depth much greater than about three feet. The resistance of water deflects shells fired into it.

MECHANIX ILLUSTRATED proposes that the solution to this problem lies in a gun firing a modified depth charge! The Editors asked Jacques Martial, noted commercial designer and student of war methods and weapons, to study the problems which such a gun would present and to design a gun of this nature. His conception of this proposed new defensive weapon is presented on these pages. The idea has been forwarded by MECHANIX ILLUSTRATED to the Navy Department for consideration by the government.

The gun, as conceived by Mr. Martial, is similar in many respects to an old-fashioned whaling cannon—and it would be used in much the same way that such cannon are used today to harpoon whales.

It would operate on a free swivel mount, being aimed and fired in exactly the same manner as a harpoon gun is. The chief innovation of the idea is the manner by which the depth charge is treated as a harpoon.

Ordinary depth charges are either dropped from the stern of a destroyer, thrown from the side of the destroyer deck by a "Y" gun, or fired by a cartridge-compressed air device. Both of the latter devices, however, lob the depth charge into the air in the way that a high-angle howitzer



A destroyer launches her torpedo (above), while a diagram of a "tin fish" is at right. Some details, war secrets, are not shown.

throws its charge. This method of throwing a depth charge is much too slow to be used against a torpedo.

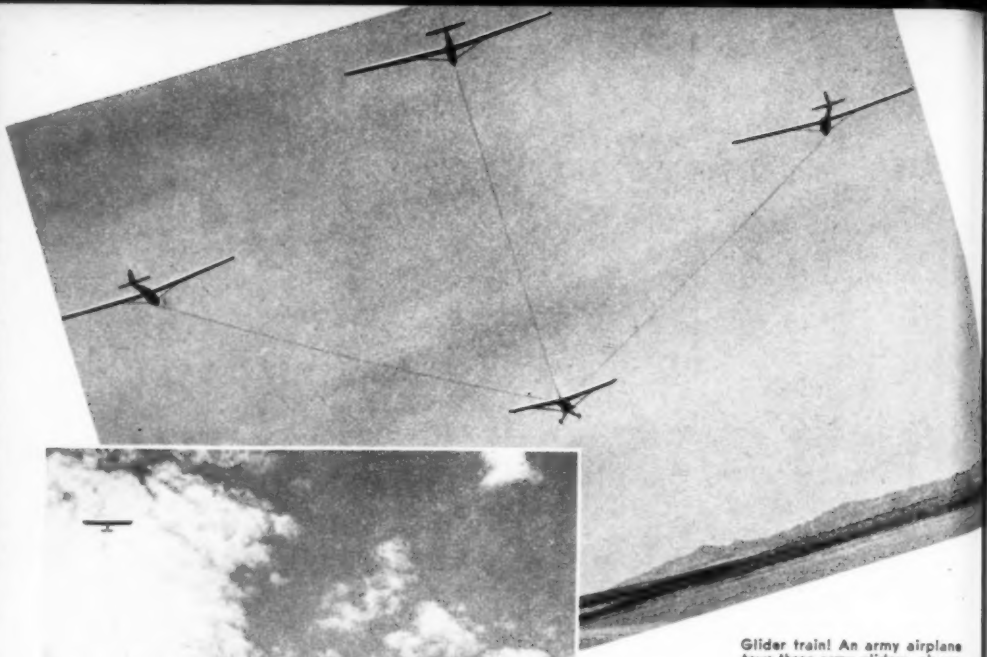
The gun proposed herewith by MI would fire its depth charge horizontally. The "shell" would consist of 75 pounds of TNT on a "stick," or handle. This handle would fit into the muzzle of the gun itself. The gun would be loaded with either a 37mm or a 75mm cartridge, which would fire the projectile. In the nose of the TNT charge would be hydrostatic fuse, such as that with which an ordinary depth charge is equipped.

This hydrostatic fuse could be set so that the TNT will explode at any desired depth. Torpedoes fired at merchant vessels, for instance, usually travel at a depth of about 10 feet. Those fired at a battleship usually travel at a depth of 15 feet. Torpedoes dropped from a torpedo plane usually travel at a lesser depth. The fuse could be set to explode at whatever depth the torpedo was travelling.

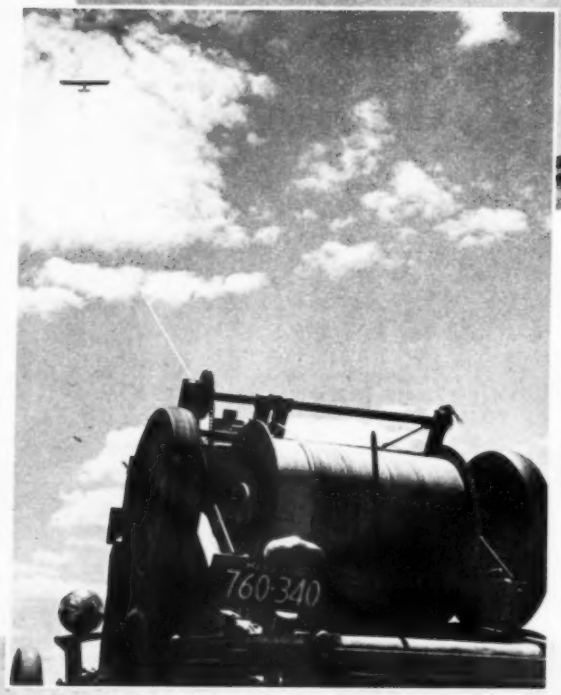
A gun crew on a merchantman could quite plausibly swing such a gun into action immediately that a torpedo alarm was given and fire several of these missiles at an oncoming torpedo before it reached their ship.

Given the depth of the torpedo and the speed at which it is traveling, it would be simple to calculate the distance in advance of the wake at which the harpoon-depth charge should be fired.

The beauty of such a projectile is that it would not be necessary to score a direct hit—or even a near hit—on the torpedo in order to incapacitate it. A charge of 75 pounds of TNT exploding anywhere within a 50 to 100 foot radius as a [*Continued on page* 156]

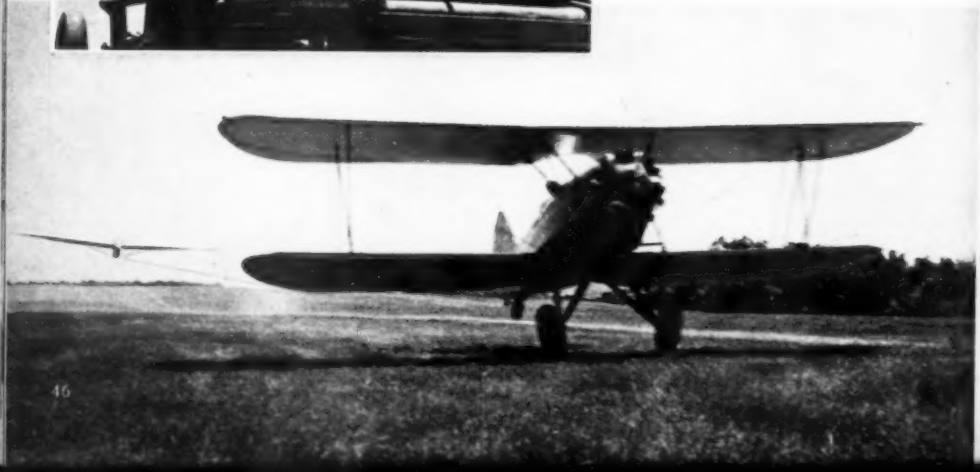


Glider train! An army airplane tows three army gliders, above.



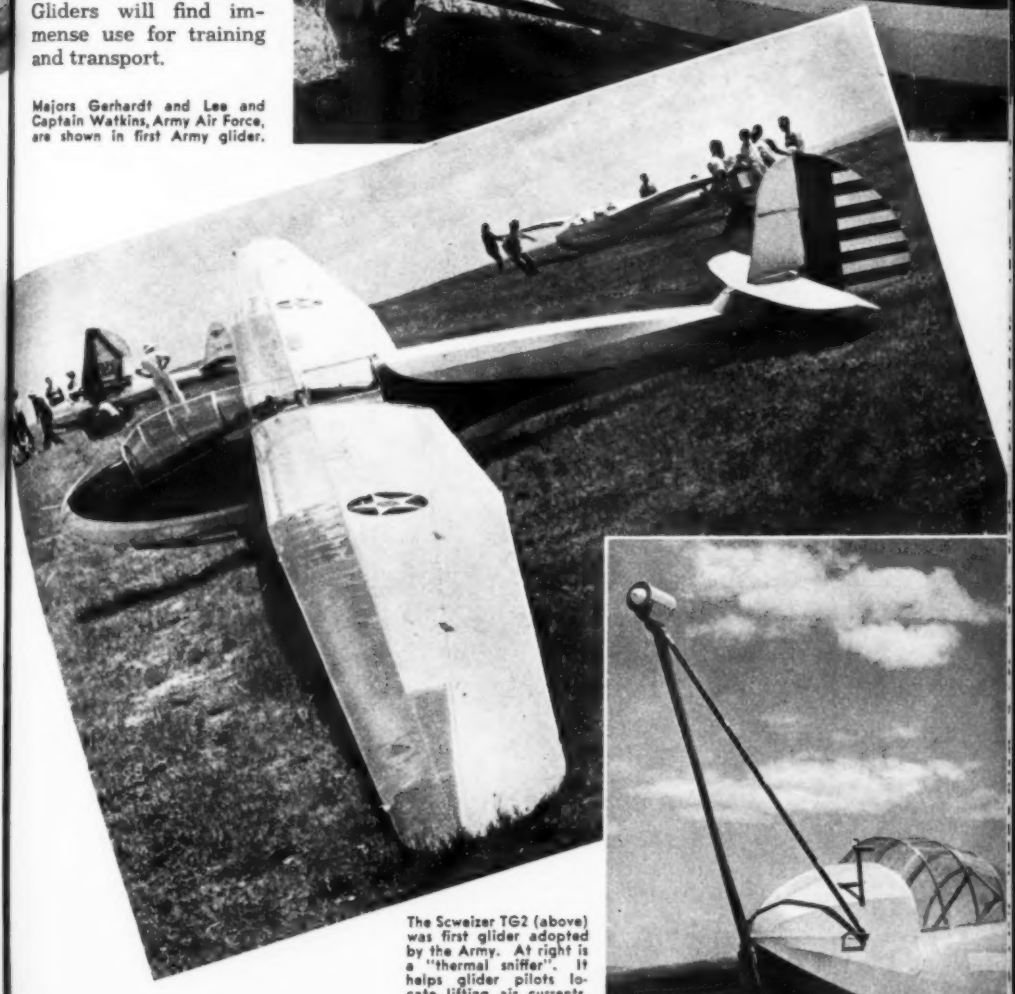
The Army Takes To Gliders

Fastest way to get a glider into the air is through the use of a stationary winch, shown at left. But to get altitude quickly, the Army tows gliders directly off the ground by airplane, as seen at bottom.



LONG before Hitler invaded the Island of Crete with glider-borne troops and tanks, the U. S. Army was cognizant of the value of gliders in military operations. The rules of censorship prevent our revealing the details of how thoroughly the U. S. Army has gone in for gliding for military uses, but the pictures reproduced on four pages herewith have been passed for publication. Gliders will find immense use for training and transport.

Majors Gerhardt and Lee and Captain Watkins, Army Air Force, are shown in first Army glider.

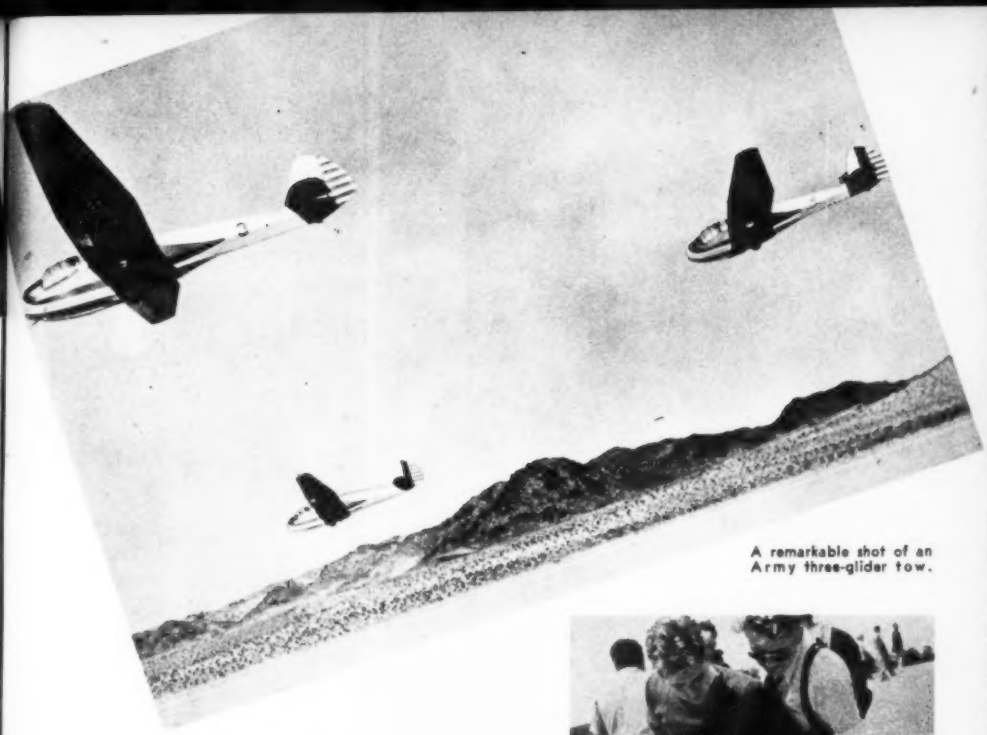


The Scweizer TG2 (above) was first glider adopted by the Army. At right is a "thermal sniffer". It helps glider pilots locate lifting air currents.

This gull-wing glider of German design, was bought by the Army for experimenting.

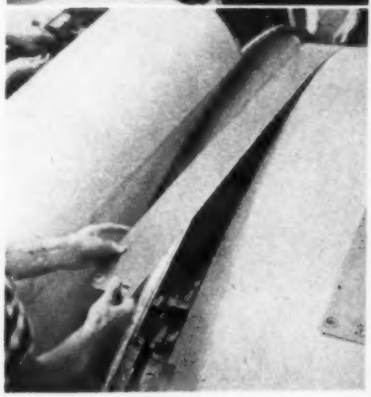
Army officers flash the clear signal to glider pilots, (at right).

Gliders are made so that they may be taken apart in a few minutes and easily transported.



A remarkable shot of an Army three-glider tow.

Only a few bolts hold the glider wings to the fuselage, as the three pictures below show. Bolt slot is covered with strip, seen below right.



The Truth A

Faith in 'Sea Otter'

President's View of Ship Design Maps a Course for Senate Inquiry

By ARTHUR KROCK
Special to THE NEW YORK TIMES.

WASHINGTON, ——The President made it clear at his press conference today that he has not lost faith in the proposed new type of convoy ship known as the "sea otter," despite discouraging preliminary trials of the craft. This will [illegible] stimulate a Senate Naval [illegible] committee to carry [illegible] has begun to [illegible] reasonable [illegible] vessels [illegible]

testing, though the in[illegible] not officially referred tering or Bush office

These sea-otters [illegible] feet long, almost fl[illegible] designed to carry [illegible] cargo. Their adv[illegible] they can be si[illegible] built of simple [illegible] rate parts in [illegible] the parts we[illegible] dock or a rive[illegible] these critici[illegible] they are [illegible] prop[illegible] dov[illegible]

"Sea Otter II" is pictured here in her test trials. Her inventor says this model differs greatly from his original conception for it.

engines are [illegible] materials [illegible] their pos[illegible] engined. [illegible] sent an [illegible] on pos[illegible] ain on [illegible] ts of [illegible]

TODAY and TOMORROW

By WALTER LIPPMANN

A striking and important illustration of the problem is to be found in the history of the Sea Otter ships. The idea of these ships was conceived by a naval officer, and in theory at least the idea was like an answer to a prayer. Here was a ship which could be built quickly and in mass production without drawing seriously if at all upon the ordinary shipbuilding capacity of the country. It was designed to present a relatively small target to the submarine. It could be operated almost entirely by [illegible] with a good automobile engine. [illegible] brilliant invention, the Japanese will not have red the attention of the world as they have had in Malaya and Burma, sm of the [illegible] ary of the [illegible] of public [illegible] ship [illegible] reside[illegible] hand[illegible]

with a view to finding [illegible] the new idea work[illegible] the matter could [illegible] to the Maritime [illegible] though that w[illegible] with cargo [illegible] mission [illegible] tempt[illegible] the [illegible] other[illegible] ves[illegible]

relief, and we've got to be [illegible] the enemy chooses to pitch [illegible] enemy is now Japan.

Lo[illegible]

TODAY IN WASHINGTON By David Lawrence

Facts About the Fabulous Sea Otter Soon to Be Known.

Washington, ——Every war has its miracle ship and this one is no exception. But whether we have such a ship is still a matter of controversy and the Senate Naval Affairs Committee has appointed a sub-committee headed by Senator Gillette, Democrat, of Iowa to find out.

The miracle ship has been called the Sea Otter. It carries a cargo of 1,250 tons. It is powered by sixteen automobile engines and the steel hulls can be welded together in four to six weeks' time. Since it draws only eleven feet, and the average torpedo fired from a submarine travels about fifteen feet below the surface, it is assumed that the mirsle ship would avoid most of the torpedoes. Sea Otter has been under consideration for President Roosevelt took a deep interon was built. Then a full- model was carried out successued a rosy announce- last September.

in the next few months while the larger fleet of 10,000-ton cargo vessels are under construction.

4—The big cargo vessels can be diverted to other duty while the smaller ones take the dangerous courses.

5—Enough gasoline can be carried to take the boats to Europe and back without refueling.

Now, while the Navy Department has said nothing about the Sea Otters since last autumn, it has been learned from other sources that the idea is formally abandoned as impractical and that President was satisfied a thorough consideration has been given to the plan.

But as often happens with a new idea, a circumstance which was valid last September might not be the same a few months later under other conditions. The need of ships was far less acute when America entered a two-ocean war last December than it has become since that time.

Promise a Bridge of Ship[illegible]

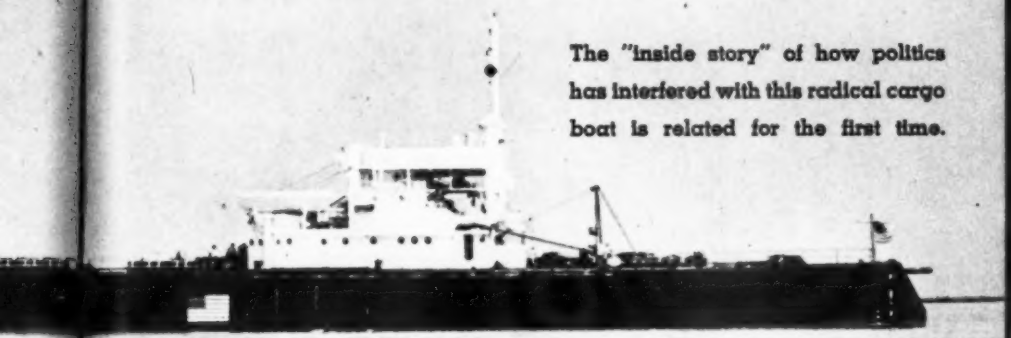
If it is true that literally thousands of [illegible] on cargo vessels can be built in quick time [illegible] cargo to some of the many [illegible] there is today a need for [illegible] the experts should [illegible]

th About the "Sea Otter"

by Warren Noble

Originator and Inventor of the "Sea Otter"

The "inside story" of how politics has interfered with this radical cargo boat is related for the first time.



THE *Sea Otter* has become a national issue. I didn't wish it to become so. From the first, my primary feeling about this illegitimate boat has been that it should have been kept a military secret. It was designed to do one job—a unique job, of great importance both to our national defense and to that of Great Britain.

However, the Navy Department has seen fit to release public statements on the *Sea Otter*. Since that time it has assumed such national importance that Secretary of the Navy Frank Knox has publicly denounced

ASKS 'FAIR' TRIAL FOR THE SEA OTTER

Senate Subcommittee Says That New-Type Ship Has Not Received Full Consideration

CRITICIZES NAVY AGENTS

Report Declares Also Some in Maritime Board Are Hostile to the Project

Special to THE NEW YORK TIMES.

WASHINGTON, ——— A Senate Naval Affairs subcommittee established to investigate the possibilities of the Sea Otter as a small, wartime freight carrier, reported its conclusion today that the experimental ship has not had "full fair consideration" at the hands of the Navy Department and

President Orders Work On Sea Otter Continued

Roosevelt Takes Job from Navy And Turns It Over to Designer

By CHARLES T. LUCEY, World-Telegram Staff Writer.

WASHINGTON, ——— The cargo ship, given an official months of experiment, Roosevelt's appro development of this President as new as the de

Reds

ABOUT THE AUTHOR:

Warren Noble is one of the great engineers of the world. Born in England, he raced automobiles in England and France as a young man and came to America in 1906 as an automotive engineer. In Detroit, he became associated with many of the "old timers" of the automobile industry, including Henry Ford, William Knudsen, Bill Stout, and others. He was general superintendent of the Dodge plant for a number of years. At the invitation of the Soviet government, he laid out several of the U.S.S.R.'s great automotive and tractor plants. He ran the huge Stalingrad works for a time, having 750,000 workers under him. Recently he has been working on a number of secret military devices.

it. President Roosevelt has publicly championed it, Walter Lippman, David Lawrence, Arthur Krock of the New York *Times*, and innumerable other columnists have pontificated upon it. *Time* magazine recently devoted two pages to calling it a "little stinker."

I would be happy to say nothing whatsoever about it—to let the *Sea Otter* sink into the morass of official stupidity, learned nonsense and windy balderdash which it has generated. But, fortunately or unfortunately, I fathered the *Sea Otter*; I still believe it has potentialities for our war effort, and I feel it is my duty to throw what light I can upon its origins, its purposes and its possibilities. Unless someone does this, I am afraid the *Sea Otter* will be permanently scuttled, and its value, therefore, lost to the United States.

I would much prefer to present these facts anonymously. But the editors of MECHANIX ILLUSTRATED insist that I lend my name to it so that the facts may have authenticity. Since the facts are of a highly controversial nature and can be presented only in the light of my personal experience, I have agreed to this stipulation.

President Roosevelt has just authorized construction of a third *Sea Otter* for test purposes. What the third *Otter* is to be, I do not know. I can imagine, however, in the light of my own experiences with the first one. I am afraid it will be nothing like the original boat which I conceived.

First of all: What is the *Sea Otter*? It is a radical boat—so radical that boat men laugh at it and the Navy Department brass hats sniff and snuff at it.

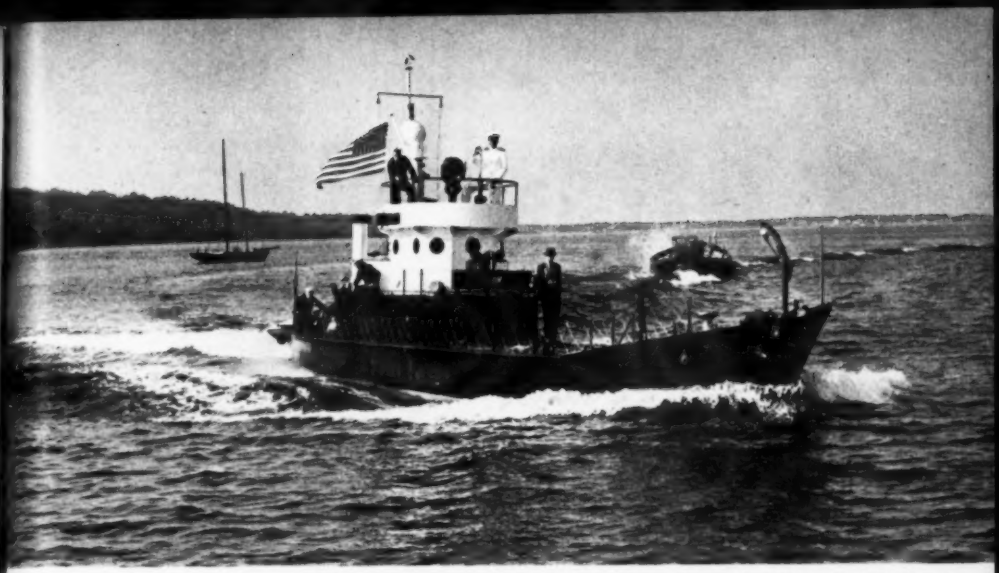
But the brass hats have lost track of one most important fact: The *Sea Otter* was not designed primarily as a *boat*. It was designed primarily as a floating junkpile powered by an outboard motor.

Let me take you back to the beginning of the *Sea Otter*. The idea for it originated at a luncheon at the home of Commander Hamilton Bryan in Washington. I had met Commander Bryan through Admiral Charles A. Courtney, and Commander Bryan was kind enough to invite me to his home. Present was the usual assortment of government people, some of whom were deeply interested in the then—catastrophic condition of trans-Atlantic shipping.

During the conversation—and I should point out that this all occurred more than a year ago, before America came into the war—during the luncheon, I say, the question of getting scrap steel and horsepower to England arose. The shipping men said America did not have the cargo space to send scrap and motors across the Atlantic, even though England was critically in need of both. The British particularly needed automobile motors to equip its tanks and military transport.

In the course of the conversation, I made the casual remark, "If England needs scrap and motors, why can't the motors be used to push the scrap across the Atlantic?" I pointed out, further, that America was producing an excess of *one million horsepower a day* in automotive type motors.

The shipping men present took up the idea. Commander Bryan was very much impressed with it. He questioned me at length concerning my idea. I told him it would be



Here is the first model of the *Sea Otter*. Note especially the small size of the crew's quarters. Then see photo *below!*

simple to put together a boat of steel scrap, power it with automobile-type engines and push it across the ocean to England—where the boat (and this was the most radical premise of the whole idea) could be broken up for scrap and its engines allocated for other uses.

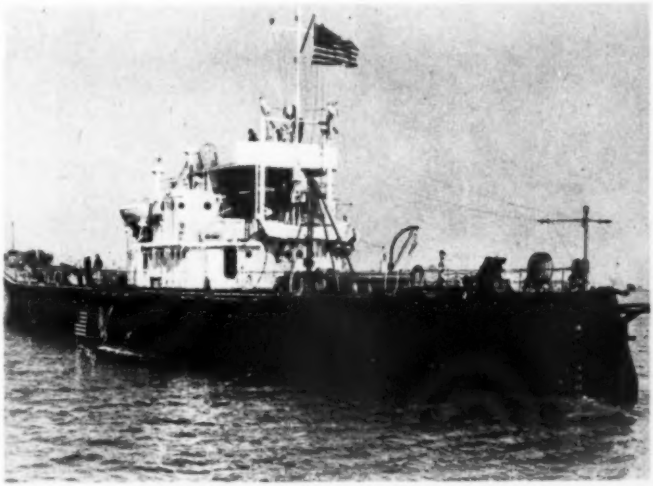
This, then, was the original germ of the *Sea Otter*. It was simple. Take steel scrap —as heavy as possible. Put it together. Power it with automobile engines with outboard-type transmissions. Let the critically needed motors push the critically needed steel across the ocean. Then let the British break up the boat into scrap steel, take the motors for its tanks and trucks—and let that be the end of the boat.

The idea was so plainly sensible, in view of the urgent British needs and the shortage of British-American shipping at that time, that it took fire. Washington grabbed it. Shipping circles buzzed with it. The Secretary of the Navy expounded upon it at a meeting of the President's Cabinet. It sounded wonderful.

In order to record the idea, I filed specifications on the *Sea Otter* with the Patent Office through a Washington law firm.

As I conceived the *Otter*, it was an extremely simple boat. The hull was to be machine-welded of steel strip, in order to speed production and lower cost. It was to be powered with automobile motors; it was to have "inboard-outboard" propellers in wells amidships; it was to be run on gasoline; it was to carry a cargo of whatever was needed to England.

The hull was to be, roughly, a great tank with the top welded onto it. Hatches were to be cut in the "top" of [*Continued on page* 150]



Here is the second *Otter*. See how the superstructure has increased!

The Winners! MI's 2nd

1st PRIZE The grand Aeronca Defender Trainer plane, won by W. O. Holton, Dallas, Tex.

1—W. O. HOLTON, 6680 Wofford, Dallas, Texas, Aeronca plane.

2—GEORGE F. CHOCK, Box 1096, East Ely, Nevada. Crosley car.

3—JOHN GRAY, 54 Mapes Avenue, Nutley, New Jersey. Atlas lathe.

4—GERTRUDE MAGEE, 4127 Brown Street, Philadelphia, Pennsylvania. Revere movie camera and projector.

5—B. G. KNOWLES, 806 East 7th South, Marietta, Ohio. Elgin watch.

6—ELLIOTT KAMPFER, Box 948, Glasgow, Montana. Walker-Turner lathe.

7—MRS. W. C. MARSH, Sheldon, Vermont. Flytimer watch.

8—BERT MORRISON, 3270 DeSota Avenue, Cleveland Heights, Ohio. Briggs & Stratton engine.

9—MRS. W. L. HAGGARD, 4211 Burns Avenue, Los Angeles, California. Hallicrafters Marine radio.

10—E. J. HOBSON, 11831 Gilmore Street, North Hollywood, California. Sea-Pal Radio Direction Finder.

Our staff of mail sorters and just a portion of the thousands of entries in our contest.

11—M. L. Stanton, 1503 Garden Drive, San Bernardino, California. Underwood Champion Portable typewriter.

12—E. F. Magee, 4127 Brown St., Philadelphia, Pennsylvania. Hamilton Elton watch.

13—Eugene F. Haveman, 4139A Connecticut St., St. Louis, Missouri. H & H filing and honing tool.

14—E. Casaill, Box 13, Adams, Wisconsin. Whizzer bicycle motor.

15—Joy Sorgen, 4168 12th St., Riverside, California. Zephyrplane Junior sander.

16—C. E. Linn, T. B. Sanitorium, Newark, Ohio. Porter-Cable Guild Cutter or Guild Sander.

17—N. Johnson, 336 N. E. 28th St., Miami, Florida. U. S. School of Music piano course.

18—A. Ottaviano, 6001 15th Avenue, Brooklyn, New York. Eddie Bauer sleeping bag.

19—Harold Mead, 2718 Webster, Kansas City, Kansas. Herkimer model engine.

20—G. Rachuy, 1233 Knoll Avenue, Waterloo, Iowa. Delta scroll saw.

21—M. E. Staub, 336 North Plymouth Blvd., Los Angeles, California. Lionel Locomotive.

22—John P. Meadors, Williston, North Dakota. Motorola record changer.

23—L. McDonough, 934 S. 58th St., Philadelphia, Pennsylvania. Federal enlarger.

24—Leo Curtis, Jr., 349 Monterey Avenue, Dayton, Ohio, Sparton Music-Aire horn.

25—George R. Kritser, Route 1, Waterville, Minnesota. Mossberg Targo outfit.

26—Mrs. Urban E. Wendorff, Tecumseh, Nebraska. Weston exposure meter.

27—R. Brunkhorst, 2295 Bathgate Avenue, Bronx, New York. Blue Star lathe.

28—Leonard Hildeman, 3850 S.E. Woodward St., Portland, Oregon. Pflueger "Supreme" reel.

29—Montague Hyam, 15 East 55th Street, New York, N. Y. Winner water skis.

30—Frank C. Bradley, Vets. Facility, Hot Springs, South Dakota. Chicago Wheel & Manufacturing Ultra Deluxe Handee workshop tool.

31—E. M. Idle, 7220 Farwell Avenue, Chicago, Illinois. Dynamic supercharged welder.

32—E. S. Daily, 214 Glenwood Avenue, East Orange, New Jersey. Argus camera.

33—Herbert J. Idle, 7220 Farwell Avenue, Chicago, Illinois. Bausch & Lomb microscope.

34—A. Magee, 4127 Brown St., Philadelphia, Pennsylvania. Universal Corsair camera.

35—John J. Brandt, 1808 N. Harding, Chicago, Illinois. General Electric mixer.

36—Maurice H. Sanders, 2840 N. Whipple St., Chicago, Illinois. Eddie Bauer jacket.

37—Fancher Holwall, 560 43rd St., Oakland, California. S. L. Allen skils.

38—Ralph Carl Klundt, 621 First St. West Jamestown, North Dakota. U.S. Rubber raincoat.

39—A. E. Barringer, 701 N. Lorimier St., Cape Girardeau, Missouri. Stanley tool chest.

40—W. Johnson, 110 North 7th Avenue, Highland Park, New Jersey. Kalart flash gun.

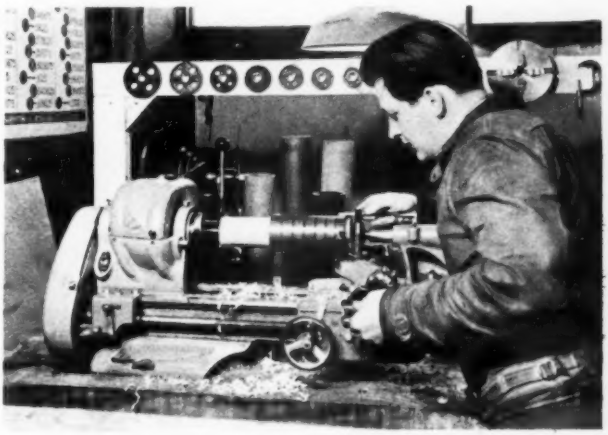
41—I. Cope, 926 Gordon St., Allentown, Pennsylvania. F. A. Smith ARCTIC-AIRE fan.

42—H. Erwin, 2122 Locust, Philadelphia, Pennsylvania. Power King deluxe jig saw.

Annual Contest

HERE they are, folks! Nearly 50,000 of you sent in your entries in MI's great "Words-Within-Words" Contest and here are the lucky winners! Our heartiest congratulations go to all of them, and especially to W. O. Holton, Dallas, Texas, postoffice employee, who walked away with that splendid Aeronca Defender Trainer. In response to many requests, we reproduce the winning entry, together with a picture of Mr. Holton, on the next two pages.

2nd PRIZE This marvelous Crosley Convertible Sedan, won by George F. Chock, Box 1096, East Ely, Nevada, for his big entry.



3rd PRIZE That $240 Atlas Lathe, with reversible automatic power! John Gray, 54 Mapes Avenue, Nutley, N. J., is the winner.

43—B. Meeker, 2440 Johnston St., Los Angeles, California. Wilson tennis racket.

44—E. Sprague, Route 1, Weeping Water, Nebraska. Dooling Bros. model racing car.

45—G. T. Hoben, 5891½ E. Cheltenham Ave., Philadelphia, Pennsylvania. Sheaffer pen and pencil set.

46—Willard N. Jordan, 248 W. Spring St., Columbus, Ohio. Fec & Stemwedel field glasses.

47—Mrs. Eddie Stoll, 4625 Felton St., San Diego, California. Eddie Bauer jacket.

48—I. Collebrusco, Langleyville, Illinois. Lobaugh model refrigerator car.

49—Agnes Berger, 34-39 92nd St., Jackson Heights, New York. Iver Johnson rifle.

50—J. Arthur Taylor, 1114 North 17th St., Superior, Wisconsin. Radiant projection screen.

51—A. G. Klassen, Route 1, Box 341, Dinuba, California. Shwayder traveling bag.

52—Merle Kritzer, Waterville, Minnesota. Gilbert Erector set.

53—Peter Reinbold, Fort Peck, Montana. Wilcox, Crittenden lamp.

54—Mrs. W. N. Duck, Millheim, Pennsylvania. Junior motor.

55—William Lenz, 54 Bay 13 Street, Brooklyn, New York. Alaska Yukon sleeping bag.

56—F. W. Fletcher, 31 Grandview Avenue, Pitman, New Jersey. G-M Laboratories exposure meter.

57—Melbourne F. Brown, 425 Summit Avenue, Westville, New Jersey. Ronson lighter.

58—Mrs. B. F. Clancy, 1023 South Lincoln, Aberdeen, South Dakota. Wesbar car top carrier.

59—Mrs. M. Phillips, 2400 East Twelfth St., Des Moines, Iowa. Kirsten pipe.

60—Arthur Fox, Box 51, Cardiff, California. Hodgman duck-hunting parka.

61—John E. Lindgren, 520 Eighth Ave. N.E., Minneapolis, Minnesota. Weed tire chains.

62—Guy C. Oakes, 1447 N. Chester St., Indianapolis, Indiana. Allerding Crafty-Aid.

63—B. Beckert, 236 W. Chelton Ave., Olney, Pennsylvania. Comet kit.

64—R. J. Angleman, 1107 West 18th, Oklahoma City, Oklahoma. GHQ gas model motor.

65—G. Carleton, 1128 Bella Vista Ave., Oakland, California. Miles Kimball golf balls.

66—Thomas E. Garrett, 635 Grant St., Denver, Colorado. Ingersoll wrist watch.

67—W. E. Curtis, 2539 Burnside Avenue, Los Angeles, California. Ingersoll wrist watch.

68—Sophie Schoenhere, 2212 West Ave. 33, Los Angeles, California. Ingersoll wrist watch.

69—Frank O. Nichols, 105 Hamilton St., New Brunswick, New Jersey. Swartzbaugh Everhot timer clock.

70—C. M. Hughes, 4661 Cartwright Avenue, North Hollywood, California. Carrom game board.

71—M. Norvell, Box 54, Marissa, Illinois. Dremel Moto Saw.

72—E. Landis, 2361 Arthur St., Los Angeles, California. Trojan binoculars.

73—Mrs. N. Orman, 3538 Grand Ave. South, Minneapolis, Minnesota. Daisy air rifle.

74—Anthony J. Kelly, Mitchell, South Dakota. Boyce-Moleir sextant.

75—Harry E. Beach, 1901 Third St., Ferry, Iowa. Delta POWERlite.

76—Calvin Green, 7704 Emerson Road, W. Lanham Hills, Maryland. Hull auto compass.

77—Ralph LeMoine, 316 Independence Ave., Waterloo, Iowa. Hull marine compass.

78—D. G. Fox, P.O. Box 51, Cardiff, California. Comet gas model.

79—Leonard Lashley, Festus, Missouri. Handiweld electric welder.

80—M. M. Meade, Bayou Vista Apts. No. 14, Sanders Beach, Pensacola, Florida. Handiweld electric welder.

81—Charles Kirkland, 4224 Euclid Ave., East Chicago, Indiana. Versitool.

82—John H. Hawkins, 2205 W. 4th St., Williamsport, Pennsylvania. Marble knife.

83—Arthur Smith, Hudson Theater Bldg., Columbus, Ohio. Eberhard Faber Permapoint Pen and Pencil set.

84—L. Norvell, Box 54, Marissa, Illinois. Ace Drill sharpener.

85—Mrs. C. W. Kidd, 717 First St. S.W., Roanoke, Virginia. Kirsten cigarette holder.

86—O. S. Mustad, 1206 Roseglen St., El Monte, California. Polaroid glasses.

87—Ira Eckstein, 1714 E. 8th St., Brooklyn, New York. Polaroid glasses.

88—E. H. Shinabargar, 416 S. 22nd St., Council Bluffs, Iowa. Polaroid glasses.

89—Wallace K. Williams, RFD 1, Chateaugay, New York. Polaroid glasses.

90—Rudolph Bailey, Handshoe, Kentucky. Polaroid glasses.

91—Charles Sedenger, 3835 N. Darien St., Philadelphia, Pennsylvania. Polaroid glasses.

92—Raymond D. Andrews, 414 Broadway, Albany, New York. Taylor-Shantz jig saw.

93—John J. Black, 622 Chestnut St., Arlington, New Jersey. G-H lap table.

94—Oliver L. Rachuy, 1233 Knoll Avenue, Waterloo, Iowa. Comet model plane.

95—R. W. Wharton, 21 N. Johnson, Iowa City, Iowa. Christy sport knife.

96—John McDermott, 274 West 19th St., New York, N. Y. Grip-Tite Faucet repair set.

97—R. Miles Brooks, 723 Howard Avenue, New Orleans, Louisiana. *Bonnie* blueprints.

98—H. Jervey, 1257 Morse St. N.E., Washington, D. C. *Tahiti* blueprints.

99—L. Meeker, 16181½ West 105 St., Los Angeles, California. *Pontos* blueprints.

100—R. G. Armknecht, 47th and Pine St., Philadelphia, Pennsylvania. *Yaughterman* blueprints.

PUZZLE NO. 1

									TOTAL
P (1)	R (1)	O (1)	P (2)	O (2)	S (1)	E (1)	R (2)		11
H (1)	O (3)	R (3)	O (4)	P (3)	T (1)	E (2)	R (4)		21
O (5)	T (2)	O (6)	R (5)	R (6)	H (2)	E (3)	A (1)		30
T (3)	R (7)	O (7)	O (8)	P (4)	E (4)	R (8)	S (2)		43
O (9)	P (5)	E (5)	R (9)	A (2)	T (4)	O (10)	R (10)		54
G (1)	A (3)	R (11)	R (12)	O (11)	O (12)	S (3)			53
R (13)	O (13)	O (14)	T (5)	E (6)	R (14)	S (4)			69
A (4)	E (7)	R (15)	O (15)	P (6)	H (3)	O (16)	R (6)		82
P (7)	R (17)	O (17)	T (6)	O (18)	R (18)	E (8)	S (5)		96
H (4)	O (19)	O (20)	T (7)	E (9)	R (19)	S (6)			84
E (10)	T (8)	O (21)	R (20)	O (22)	S (7)				88
R (21)	O (23)	O (24)	S (8)	T (9)	E (11)	R (22)			118
S (9)	O (25)	R (23)	O (26)	R (24)	A (5)	T (10)	E (12)		134
								TOTAL	883

NAME W. O. HOLTON
ADDRESS 6680 WOFFORD
CITY DALLAS STATE TEXAS

If you were sponsored in this contest fill out the following. If not, leave these spaces blank.

SPONSOR'S NAME L. K. WHITTEN
ADDRESS 7310 FILLMORE
CITY DALLAS STATE TEXAS

Save this puzzle until you have completed puzzles No. 2 and No. 3, appearing in the March and April issues of MECHANIX ILLUSTRATED. Send all three completed puzzles in together.

81

And here is W. O. Holton, Dallas, winner of the first prize. He writes: "I am 27 years old and a letter carrier. I have a wife and two small children and we are buying a house on the outskirts of Dallas. I find nothing more enjoyable than working in my workshop and I have built many household projects for which I am indebted to MECHANIX ILLUSTRATED for its many ideas and suggestions. I have just recovered from three months in bed with rheumatic fever—but I'm well now!"

Where Word Is Found In Webster's New International Dictionary, Second Edition.

PAGE 1985
PAGE 1202
PAGE 1729 UNDER "OTO"
PAGE 2720
PAGE 1707
BOTTOM OF PAGE 1035
PAGE 2167
PAGE 41
PAGE 1992
PAGE 1198
P. 3056 PL. WITHOUT REFERENCE TO MEANING. SEE P. LXXX, SEC. 18 PARA 4
PAGE 2166
PAGE 2401

SINCE many of our contestants have requested it, we reproduce on these two pages the entry which won an Aeronca plane for W. O. Holton of Dallas, Tex., together with the page references showing where each word is to be found in Webster's New International Dictionary, Second Edition.

We must again repeat that we cannot attempt to enter into correspondence concerning the contest and we must take this opportunity to apologize to our readers who have written us in the past for not replying to them. There are just so many entrants that it is utterly impossible to answer their mail.

Few contestants who understood the rules had higher scores than Mr. Holton's, and in each case these contestants used improper words. Some of the more common of these improper words are discussed in The Editor's Workbench Section in this issue.

PUZZLE NO. 2

									TOTAL
I	N	T	E	N	S	E	S		11
N	I	N	E	T	E	E	N		28
V	E	N	E	N	E	S	T		41
E	T	I	E	N	N	E	S		58
N	E	E	S	E	S				60
T	E	N	N	I	S	E	S		78
I	N	S	E	N	S	E			86
V	I	E	N	N	E	S	E		110
E	V	E	N	N	E	S	S		132
N	I	N	E	T	I	E	S		125
E	S	T	I	E	N	N	E		158
S	I	E	N	N	E	S	E		183
S	T	E	E	N	I	E	S		183

TOTAL 1253

Where Found In Dictionary

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PAGE 1653
SUPERLATIVE OF ADJ. "VENENE." P. 2827
PAGE 3170
UNDER "NEEZE" P. 1637
3 RD. PERSON SING., PRES. INDICT. OF VERB "TO TENNIS" P. 2601
PAGE 1285
PAGE 2842
BOTTOM OF PAGE 884
REG. FORMED PL. P. 1653
PAGE 3170
BOTTOM OF P. 2332
PL. WITHOUT REFERENCE TO MEANING PAGE 2467

PUZZLE NO. 3

									TOTAL
A	C	C	R	E	A	S	E		11
E	A	R	A	C	H	E	S		22
R	O	S	A	C	E	A	E		33
O	C	E	A	N	I	C	A		37
M	A	E	C	E	N	A	S		50
E	N	S	E	A	R	C	H		54
C	A	N	A	C	E	E	S		79
H	E	R	M	A	E	A	N		73
A	R	E	A	C	H	E	S		94
N	E	A	E	R	A	S			95
I	N	C	R	E	A	S	E		99
C	A	N	A	R	E	S	E		128
S	C	R	E	E	M	A	N		119

TOTAL 894

PAGE 17 — BOTTOM
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P. 3102 UNDER "OCEANIA"
PAGE 3187
PAGE 851
BOTTOM OF P. 387 - PLURAL
PAGE 1168 BETWEEN "HERMA" & "HERMAIC"
P. 145 3RD PERS. SING.
PAGE 1633
PAGE 1260
BOTTOM OF P. 388
PAGE 2247

I Saw the SUICIDE MARCH OF TH

One of the few white men to have witnessed the mystery migrations that have baffled scientists tells his amazing experience.

by Angus Gavin

Arctic Post Manager for the Hudson's Bay Company

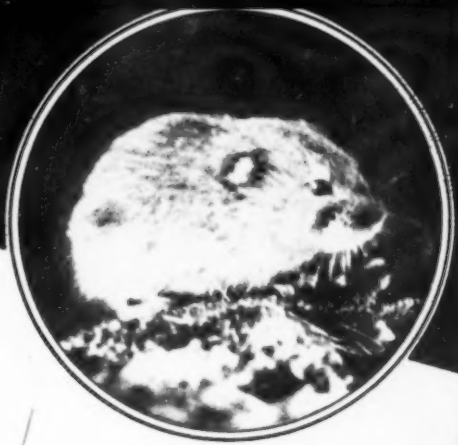
as told to Ormal I. Sprungman

Arctic adventurer and naturalist, Gavin poses in his Eskimo parka.

EDITOR'S NOTE: Angus Gavin, discoverer of the breeding grounds of the Ross' and Tule Geese—object of search by explorers for the past 80 years—has just returned to civilization after spending many years in the Arctic. In this article he tells of the rarely seen suicide migration of lemmings which he witnessed at Perry River, Queen Maud Gulf, 75 miles north of the Arctic Circle. As an amateur naturalist, Gavin has made important ornithological discoveries in the unmapped and unexplored territory south of Queen Maud Sea.

Mechanix Illustrated drawing by Reynold C. Anderson

OF THE LEMMINGS



A Back's lemming, a striking close-up believed to be the only photo of its kind.

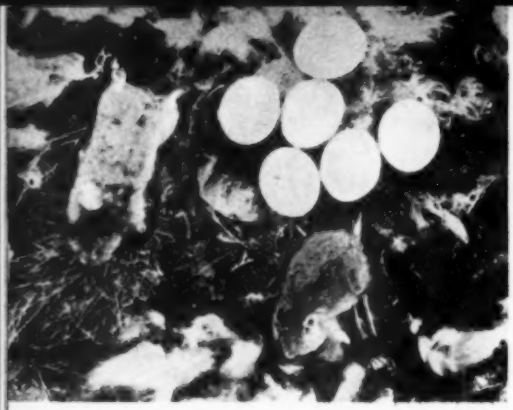
Gavin's house and Hudson's Bay Post on Flagstaff Island, Arctic Ocean, 75 miles north of the Arctic Circle. While en route to this barren outpost, he saw the lemmings marching to icy death.

EVERY time I returned to my tent where I camped, I had to drive out a dozen or more lemmings. When this had occurred several times in one day, I looked about me and saw that lemmings were everywhere on the tundra. That night, whenever I awoke, I could hear my dogs, curled up outside the tent in the snow, killing the little creatures.

My team of 13 dogs had brought me from Bathurst Inlet to Perry River—300 miles in five days—where I was to re-open the Hudson's Bay Company post. I was camped at the old post site at the mouth of the Perry River. The new post was to be opened on Flagstaff Island, 12 miles out in Queen Maud Sea, where navigation was not so complicated.

For four days I checked and loaded stores for transport by sled to the new post. Each day the lemmings became more numerous. The tundra was alive with them. On the fourth day I started north with a full load.

I soon realized that I was cutting through a mass migration of lemmings. They were everywhere on the sea ice, all traveling due east. As far as the eye could see in any direction, the lemmings were on the march.



Beasts and birds of prey feed on the mouse-like lemmings. Two small victims are shown above in a white owl's nest.

It was the first of May, and pools of water covered the sea ice. Open leads, 10 to 20 feet wide, gashed the ice. But the lemmings stopped for nothing. They never hesitated, but plunged from the ice edge to the water a foot below and swam across. On the other side, they tried vainly to climb the sheer wall of ice. Thousands drowned, but they came in never-ending numbers. Around the ends of the leads, they pressed on. Through the pools they swam without the slightest deviation from their easterly course.

My dogs snatched up lemmings as they ran along. They gorged themselves so that their bellies visibly distended. They were so surfeited that by the time we reached Flagstaff Island they could barely stagger. They were useless for further work that day.

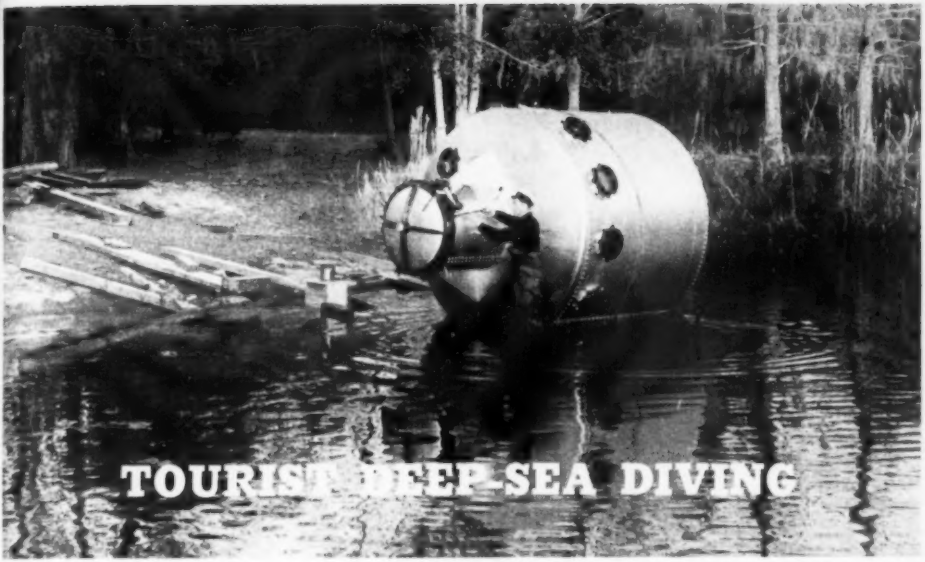
I estimated that the average density was one lemming to every square yard. Later inquiries from the Eskimos revealed that the mass migration was going on at the same time at the Kogyuak River, 45 miles east, and for at least 15 miles west of the post. The peak was reached on May 3 and 4 and gradually tapered off and ceased about May 7. From start to finish, the movement lasted for 10 days.

Back in 1934, I had witnessed a smaller migration from King William Land, south over the sea ice to the Adelaide Peninsula. It was not anything like the density or duration of the Perry River migration.

Back's lemming is a brown, mouse-like animal which does not change to white in winter as does the Arctic lemming. It is probably the most important animal in the Arctic, for it is the food of the white fox, tundra wolf, rough-legged hawk, snowy owl, and other birds of prey.

In fact, from 1938 to 1941 at my northern post, I based the credit rating of the Eskimo hunters on the abundance or scarcity of snowy owls. My 14 years of experience in the Arctic had taught me that when snowy owls were abundant, so were the lemmings. When the owls were scarce or absent, lemmings were likewise scarce. I watched the owls themselves, and when they were plentiful, I knew that lemmings would be numerous, too, and that white foxes would have large litters. This foretold [*Continued on page* 160]

Gavin's camp, even the interior of his tent, was alive with lemmings. His sled dogs gorged themselves into helplessness.



TOURISTS 1 EEP-SEA DIVING

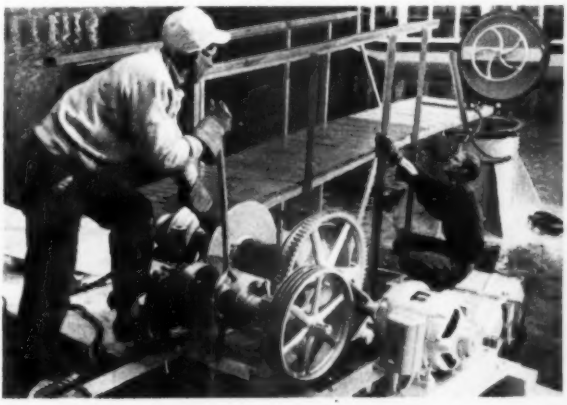
Lying in shallow water, the 20-ton bell, originally built for submarine movie-making, awaits a new load of 12 tourists.

The world's largest diving bell now takes landlubbers exploring far below the surface!

by J. Julius Fanta

ONCE accessible only by the few men and women who ventured to submarine depths in diving suits, the scenic wonders of aquatic gardens at the bottom of Silver Springs, Florida's famed springs of crystal-clear warm water, are now being viewed by entranced tourists—in groups! Until a huge jug-shaped diving bell was adapted to accommodate a dozen tourists at a time, one for each porthole through which the watery scenery can be viewed, they had to content themselves with glimmery ideas of the beauty at the bottom of the water through which they peered from the surface. Now they get inside the diving bell, like so many Dr. Beebes in a Bathysphere-like contrivance, are sealed in by a metal hatch resembling that on a submarine, and then are hauled thrillingly to the bottom, many feet below. Deepwater wonders are thus being pleasantly enjoyed by men and women who would never consider going down if it meant using diving suits.

Originally, the bell, the largest in existence, was built for photographing underwater movies for Hollywood. Max Gene Nohl, whose descent 420 feet in a flexible diving suit set a world's record, adapted the bell for sightseeing purposes. Since the steel submersible is so buoyant its natural tendency is to ride the surface when free, it must be pulled down to penetrate the depths. The bell resembles a huge wine jug in shape, the neck accommodating the entrance which is sealed with a cap-like hatch. Each passenger, after reaching the hatch from [*Continued on page* 153]



Tourists reach the hatch via gangway above, then descend to the interior on a tiny elevator. Electric winch in foreground pulls bell to bottom.

NOW YOU CAN FLY ST

While Igor Sikorsky sits comfortably in the cockpit of his helicopter, hovering motionless a few feet in the air, an assistant calmly removes one of the landing wheels. The ship floats about without it briefly, then wheel is replaced to land.

An interview with Igor Sikorsky *by* George Daniels

Another dream has come true in the air. Now—not some time in the nebulous future, but right now—you can step into an airship that will fly straight up; an airship that will stop dead in midair and hover there like a hummingbird; an airship that will back up in the air like an automobile does on the ground; an airship that will fit into any ordinary garage, and take off or land in a 50-foot back yard; an airship that you can park in crowded traffic on any metropolitan street. This airship will not stall or spin. And—most unbelievable—you can *turn off its motor* while it is in flight and it will descend to the ground without even a jar!

This sensational flying machine is the helicopter and the man who brought it into being is one of the greats in Aviation's Hall of Fame, Igor Sikorsky. We thought all MECHANIX ILLUSTRATED readers would want to know what is anticipated for this amazing machine by its creator, so we obtained permission to interview Mr. Sikorsky recently and came away with the following approved interview:

IGOR SIKORSKY had a twinkle in his eye when he greeted me in his office at the giant Vought-Sikorsky plant. He's a quiet mannered fellow, but when he talks planes he's as enthusiastic as a kid with a new bike. A few minutes before we met he'd been flying one of the most amazing ships in aviation history, the Vought-Sikorsky helicopter.

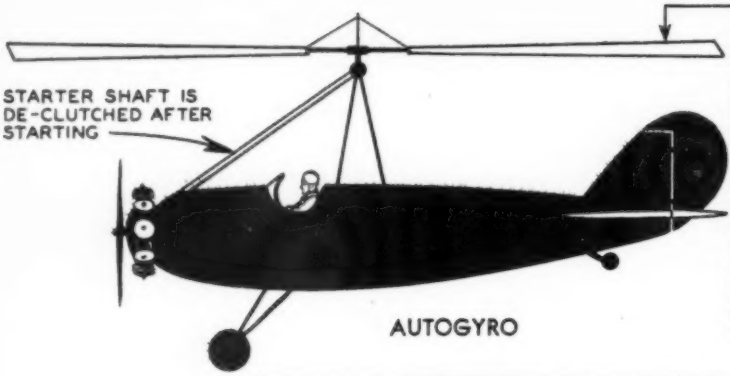
It can fly straight up, land gently straight down, or move easily through the air in practically any direction. It could take off from Bob Smith's backyard, skim swiftly cross-country, and settle down easily to a parking space on the roof of Bill Jones' apartment. And it has it all over the automobile where parking is concerned. It can hover a few feet above a space while the pilot sizes it up, then, literally hanging in the air, it can back up, edge forward, or move sideways in either direction.

Sikorsky has simplified it quite a bit since

Y STRAIGHT UP!

Sikorsky VS-300 helicopter "parks" in mid-air to lower a container to man on jagged cliff.

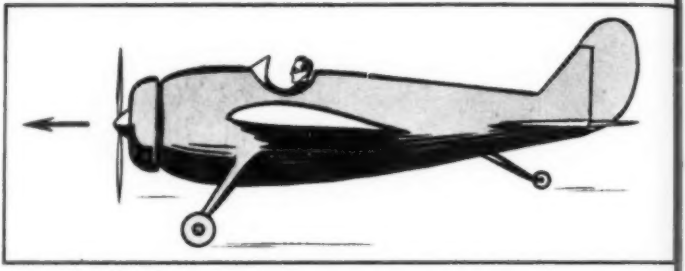
Plane, Giro, and Helicopter—How They Differ



AUTOGYRO

Rotor on autogiro isn't engine-driven except when starting. After that it continues to turn by "autorotation" in much the same manner that a conventional plane tailspins. Autogiros can land straight down safely with or without power, but they can't take off straight up except when "jumped." This method consists of racing the rotor by engine power while blades are at zero lift position—then the pitch is increased, and giro hops up vertically for a short distance. It cannot maintain this vertical ascent after rotor momentum is used up, must then climb at angle while it is moving forward.

CONVENTIONAL TYPE PLANE



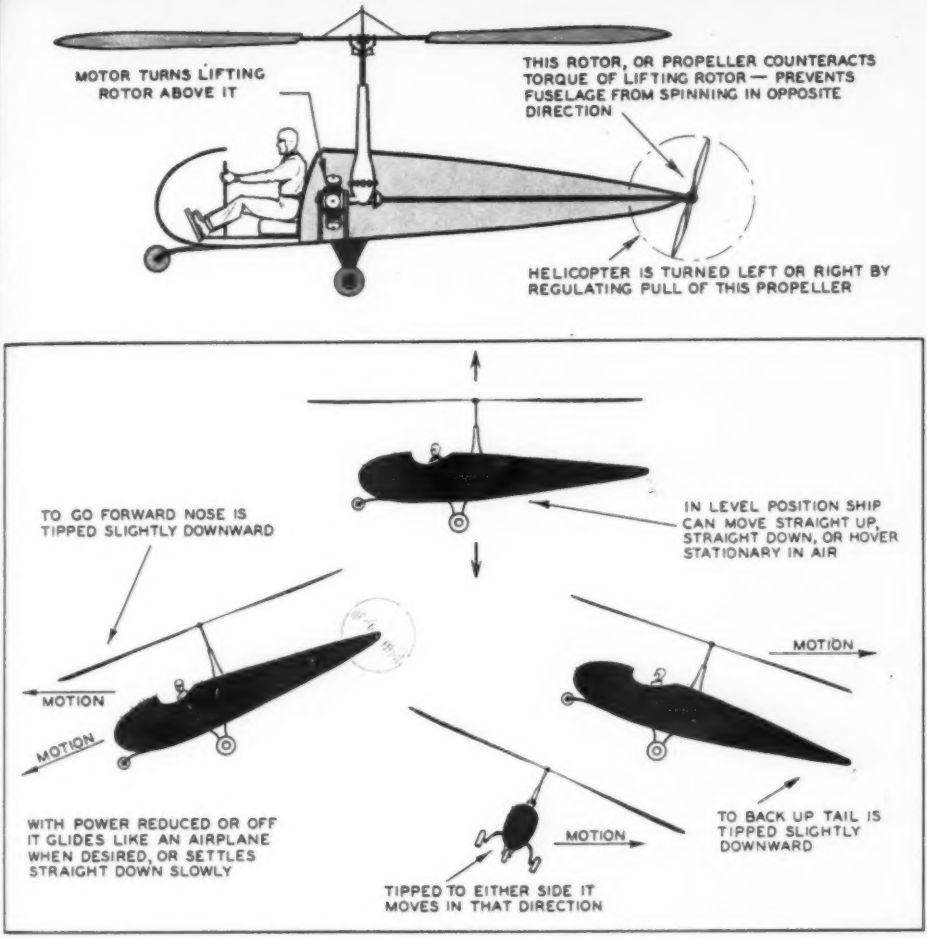
Conventional planes must keep in motion in forward direction at all times to fly and maintain control. Prop pulls plane forward, wing in motion lifts it.

he first designed it. The three rotors originally carried at the tail have been reduced to one, eliminating the outriggers, and bringing the inexpensive privately-owned helicopters of the future that much nearer to reality.

I asked Mr. Sikorsky if he thought that helicopters could be turned out at about the price of a car, and he told me that it all depends on the demand for them. "If there should be a demand for 10,000 helicopters," he said, "they could probably be made to sell at a figure comparable to moderately priced aircraft. If the demand reached the proportions it has for automobiles, the price of helicopters might be reduced to about the same as a medium priced car."

The idea of vast numbers of helicopters hopping straight up from lawns and streets fascinated me. I suggested the term "flivvercopters" for them, and Sikorsky countered with "heli-flivvers." And that's probably what they'll be called when the public takes

Igor Sikorsky was born in Kiev, Russia, in 1899. Began his aviation experiments in 1908, and built the world's biggest airplane five years later. Named the "Grand," the ship dwarfed all airplanes of the time. Since then Sikorsky has gone in largely for giant multi-engined flying boats and amphibians, the majority of his most famous ships having been built during his 22 years in the United States. The VS-300 helicopter is his latest addition to aviation history.

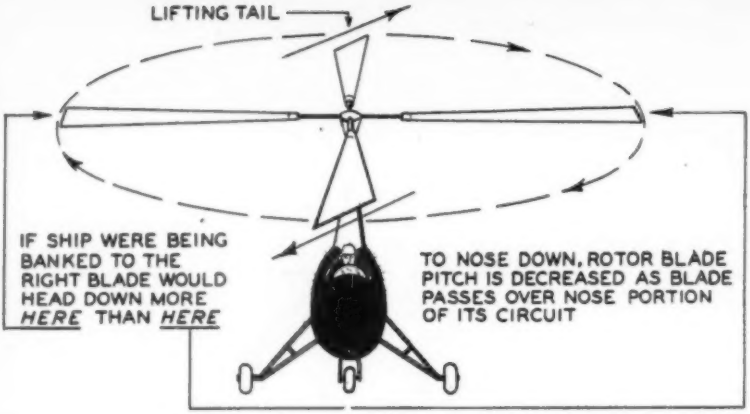

MOTOR TURNS LIFTING ROTOR ABOVE IT
THIS ROTOR, OR PROPELLER COUNTERACTS TORQUE OF LIFTING ROTOR — PREVENTS FUSELAGE FROM SPINNING IN OPPOSITE DIRECTION
HELICOPTER IS TURNED LEFT OR RIGHT BY REGULATING PULL OF THIS PROPELLER
TO GO FORWARD NOSE IS TIPPED SLIGHTLY DOWNWARD
IN LEVEL POSITION SHIP CAN MOVE STRAIGHT UP, STRAIGHT DOWN, OR HOVER STATIONARY IN AIR
MOTION
MOTION
MOTION
MOTION
WITH POWER REDUCED OR OFF IT GLIDES LIKE AN AIRPLANE WHEN DESIRED, OR SETTLES STRAIGHT DOWN SLOWLY
TO BACK UP TAIL IS TIPPED SLIGHTLY DOWNWARD
TIPPED TO EITHER SIDE IT MOVES IN THAT DIRECTION

To climb straight up from standing start on ground in helicopter, you pull lever that increases pitch of main lifting rotor and simultaneously speeds up engine. To go forward in the air, you push the conventional airplane-type control stick forward slightly and increase main rotor pitch slightly so added lift can be transformed into forward motion. Tilted, the ship slides forward on level flight path. Process is the same for backward flight except that control stick is pulled back instead of forward. Rudder pedals are used for turns as in conventional plane. These drawings are exaggerated. Top one is simplified to show principle.

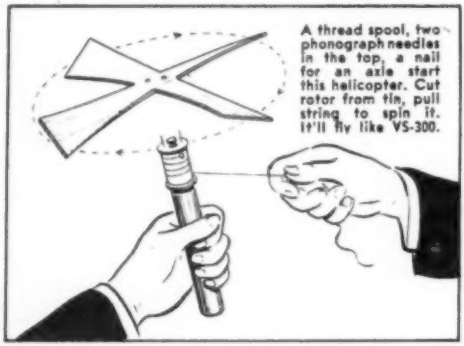
to the sky in them a few years from now. The fact that they can come to a complete stop in mid-air, and remain there, will do much to relieve aerial traffic problems. If you have to stop short when the woman down the street pulls up in front of you from the roof of the hat shop, it'll be possible to hover there for a few minutes while you bawl her out. Then you can back up and continue your flight to the office.

But all that is fantasy, and Igor Sikorsky doesn't deal in fantasy. His incredible ship is real. It's a present day actuality like the mighty Vought-Sikorsky fighters that fly with the Navy, or the huge 40-passenger Vought-Sikorsky VS-44-A now being readied for transatlantic service.

The possibility of mass production of "heliflivvers" is also very real. To my surprise, Mr. Sikorsky informed me that they can be made with very little duralumin—ordinary aircraft steel tubing being practically the only material needed for their construction. He also pointed out that the helicopter doesn't require any super engines. The same motors that are being turned out by the thousands for conventional planes are also ideally suited to the helicopter. Plants now building auto-


LIFTING TAIL
IF SHIP WERE BEING BANKED TO THE RIGHT BLADE WOULD HEAD DOWN MORE HERE THAN HERE
TO NOSE DOWN, ROTOR BLADE PITCH IS DECREASED AS BLADE PASSES OVER NOSE PORTION OF ITS CIRCUIT

Sikorsky eliminated the two outrigger rotors that acted as ailerons by rigging an individual blade control on the main lifting rotor, as shown at left. This also eliminates need for extra horizontal tail rotor to act as elevator. Control stick changes lift of individual blades as they travel past different points of the circuit, to bank, climb, or dive, or fly on level.



A thread spool, two phonograph needles in the top, a nail for an axle start this helicopter. Cut rotor from tin, pull string to spin it. It'll fly like VS-300.

mobile transmissions for the armed forces can easily produce the other mechanical parts of the helicopter—aside from the standard airplane equipment which is already in production.

Perhaps the "heli-flivver" will solve the post war problem of the aircraft industry by keeping the vast plane factories of the nation running at near capacity, to supply a civilian demand for ships that anybody can fly—anywhere. Igor Sikorsky thinks that might happen. "While it is not possible to predict just how quickly public demand will develop," he said, "it seems reasonably certain that the

Below, Sikorsky's helicopter slowly pokes its nose through dead center of 12" loop on pole, then holds it there.

Trees don't bother Sikorsky when he takes off and lands his helicopter. He's landing straight down in this photograph.

helicopter will absorb a considerable part of the industry's productive capacity when military orders are reduced after the war."

But the little 2-passenger jobs are not the only type of helicopter that Sikorsky has been thinking about for the future. He told me that larger ones could be built to carry as many as 20 passengers. These would serve as flying buses, between metropolitan areas and airports, for he does not believe that the helicopter will ever replace the airplane for high speed long distance travel or for carrying heavy loads. He sees it as an efficient means of pleasure travel and commuting.

He doesn't believe that the top speed of true helicopters will get beyond 150 miles an hour, nor that the passenger capacity will exceed 20 persons. The conventional airplane, on the other hand, can attain immense proportions. "Even at the present time," he said, "we could build a 1,000-passenger airplane along conventional lines." [*Continued on page* 174]

ADMIRAL OF A ONE-MAN FLEET

A word controls distant battleships.
A dial fires far-off guns, torpedoes.

"Admiral" Bisby and his sound-controlled *U. S. S. Kentucky*, vintage of 1900. *Insert, U. S. S. California*, radio and light controlled.

by Lester David

THE mighty aircraft carrier *U.S.S. Kearsarge* was blown up and sunk recently when an enemy torpedo, churning through the glassy water, struck her amidships as she rode at anchor in the Los Angeles Harbor.

Tracing the missile's wake, the battleship *California* sighted the marauding submarine and speedily took off after her. The invader dodged through the harbor and headed for the open sea, but the relentless pursuer cornered her in a cove and blasted her to the bottom with terrific salvos from 14-inch guns.

Above, part of the $10,000 Bixby fleet riding at anchor. At right, an impulse from control on land sends sub's torpedo into U. S. S. Kearsarge.

The story was not blazoned across the nation's front pages although it all happened exactly as described . . . but in miniature.

The principals in the "battle" were units in the amazing model navy put together bolt by bolt and screw by screw in a little west coast workshop by Howard E. Bixby, admiral of his one-man fleet.

It was the admiral who ran the entire show as he stood on shore flipping an ordinary telephone dial connected with a five-meter transmitter. A flip and the torpedo was launched, a flip and the *Kearsarge* blew up. Then the avenger went into action.

Bixby dialed No. 1, sending out a radio impulse which was picked up by the ten-foot, 350-pound flagship of the model navy, turning on her electric motor and starting her after the invader.

Manipulating a similar device controlling the submarine, he made her skitter to all sides in a desperate attempt to escape. But No. 2 on the *California's* dial turned the big battlewagon to the right as the sub turned to the right; No. 3 wheeled her to the left as the sub dodged left; No. 4 reversed her engine as the

sub darted backward nimbly as a porpoise.

After ten minutes of naval tag, Bixby maneuvered the sub into the inlet and dialed No. 5 on the pursuer's mechanism which revolved her four aluminum turrets into firing position. And, the prey measured for the kill, he dialed No. 6, causing the *California* to blaze away with the .38-caliber cartridges in her 12 guns.

And those aren't all the tricks Bixby can play with the pride of his fleet. He can control her at night by flashing a searchlight from shore across a photo-electric cell on the model. Various numbers of flashes start her, steer her, back her up, fire her guns.

Bixby's fleet, built on a scale of $\frac{3}{16}$ of an inch to the foot, consists of 12 craft, designed to represent the development of the United States Navy.

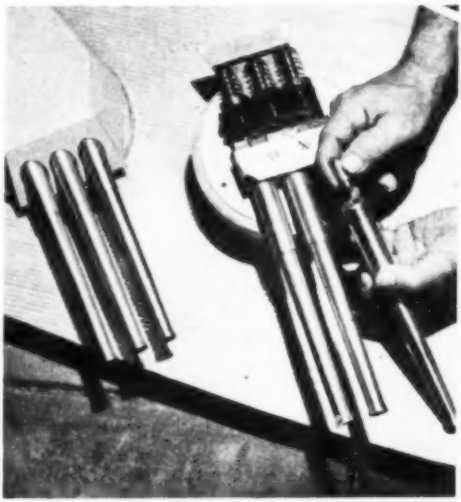
Controlled by sound, waves of light or radio impulses, they boast real cannon firing blanks, electric motors, turrets, masts, hulls, keels . . . virtually everything in miniature that went into construction of their original counterparts.

Ranging in size from four to 11 feet and weighing from 50 to 500 pounds, they operate at speeds varying from three to 15 miles an hour.

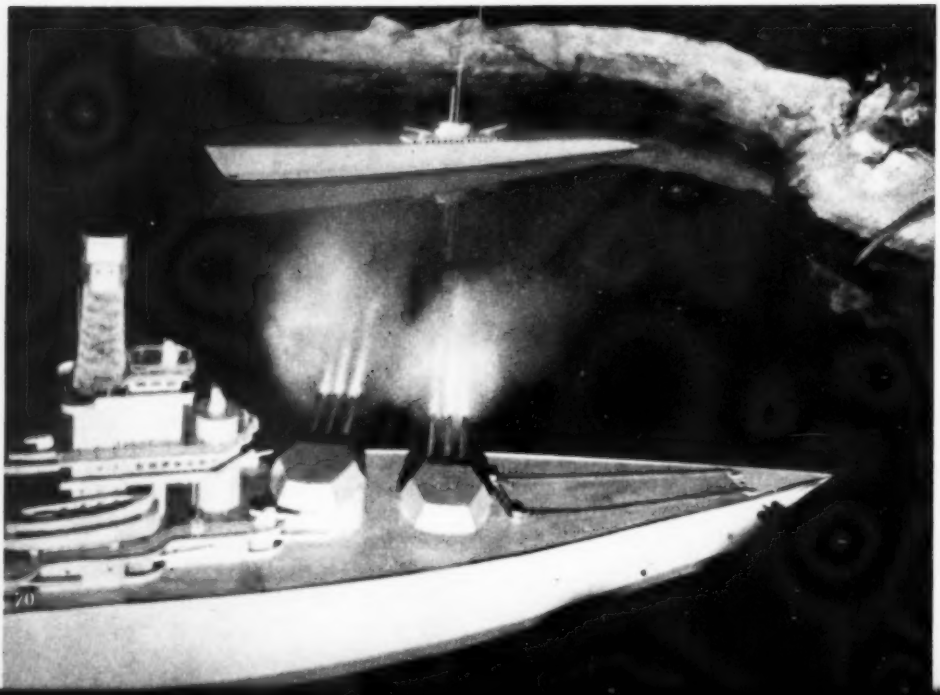
And Bixby can set them down in the ocean, a lake or a swimming pool and put them through full tactical and warring maneuvers, stalking one another, fleeing one another, torpedoing one another, sailing in formation, docking and departing.

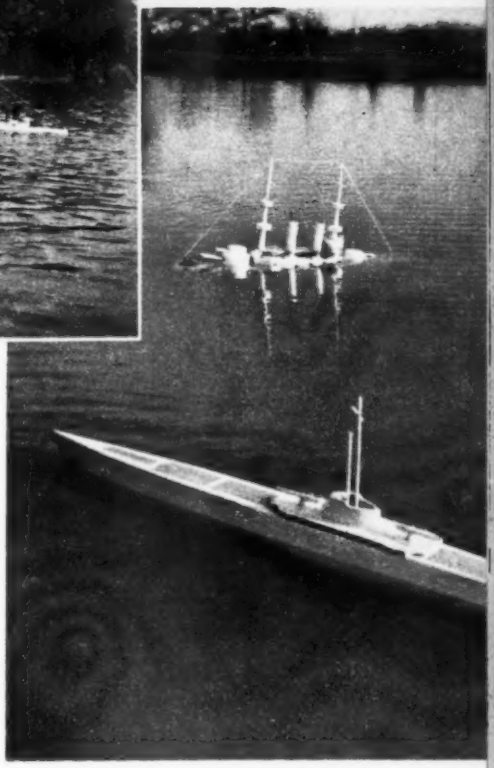
Years of labor have gone into the construction of the models, the first of which was the frigate *Constitution*, the *Old Ironsides* of early American days, built by the United States in 1797 and by Bixby in 1932.

Following the evolution of the Navy, Bixby's next craft were the *Monitor* and the *Merrimac*, the first iron clad warships which



U. S. S. California's "14-inch" guns get their load of 38 cal. blanks in photo at right. *Below*, they blaze away at the escaping sub after remote controlled chase corners it in cove.





Procession of Bixby remote controlled fleet units above is led by aircraft carrier *Saratoga*. *At right*, the *Kearsarge* does a controlled sinking job after "enemy" sub scored tropedo hit.

battled to a stalemate during the Civil War. Then, at the time of the Spanish-American War, the first modern battleship made its appearance with the *Oregon*, and a model is in Bixby's fleet.

Then came the *Old Kentucky* in 1900, the *California* in 1919, the *North Carolina* last year. In addition to the dreadnoughts, Bixby has a model of the aircraft carrier *Saratoga*, of the first destroyer built by the United States and of the last, and of the earliest and most recent submarines.

The *Oregon, Kentucky* and *North Carolina* are sound-controlled, the *Saratoga* and *North Carolina* by light and radio, and the remainder of the armada by light waves.

Bixby's maneuvering device utilizes the self-same principles of remote control in use at the present time, with a few original touches of his own. The *U.S.S. Utah*, capsized by the Japanese at Pearl Harbor, worked just this way.

On the radio-controlled ships, the impulse from the transmitter on shore is picked up by a receiver on the model. Originally transmitted at about a millionth of a volt strength, the impulse is amplified in a split second to six volts by the model's mechanism.

Aboard ship is a selector, an instrument which utilizes copper lag relays to determine which of the mechanisms are to receive the impulse and go to work. For example, if Bixby dials No. 5, the copper relays hold open the circuit as the impulse passes Nos. 1, 2, 3 and 4. At 5 the circuit is closed and contact is made.

The sound-controlled ships are operated in much the same way, except that the impulse is received by air waves. Suspended between the funnels is a microphone which picks up the sound of Bixby's voice, passing the sound waves on to the receiver. The receiver amplifies this impulse and the selector operates as before.

Bixby chuckles as he recalls the utter amazement of onlookers who watch the craft stop, go, turn and fire at the appropriate commands. His favorite stunt at the close of a demonstration is to ask a member of the audience if he would like to order the guns to blaze. The watcher gives the order, and the guns blaze.

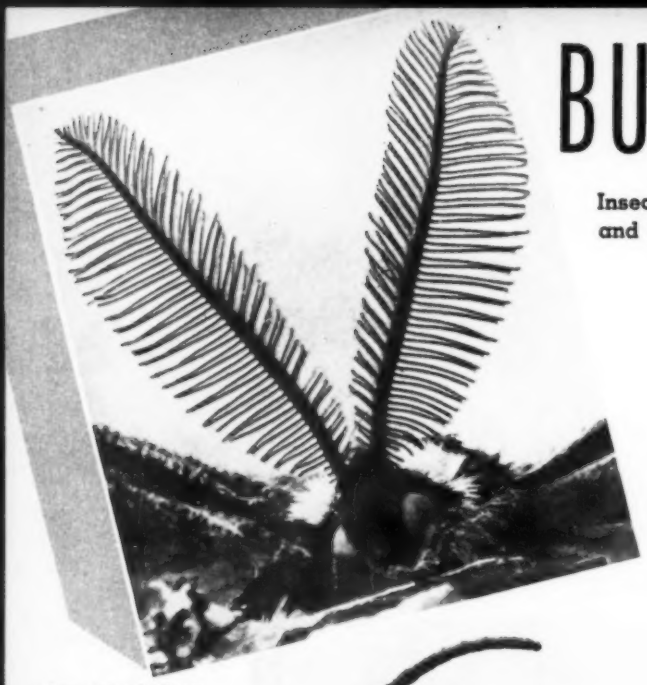
Bixby knows, if the stunned bystander does not, that the mechanism is sensitive to any sound, whether a whistle, a stamp, a sharp clap of the hands or a word. And he knows that the boat goes through its various paces in rotation, no matter what the order given. So when the next sound will cause the guns to fire, he allows his audience to take command and think they have performed a mystical feat.

And finally, the light-controlled vessels, working again in the same way, receive their impulses by means of a photo-electric cell.

Bixby's inspiration to build his fleet came in 1908, when the [*Continued on page* 164]

BUG RADIO

Insects' living aerials locate meals and mates. Inventors please copy!

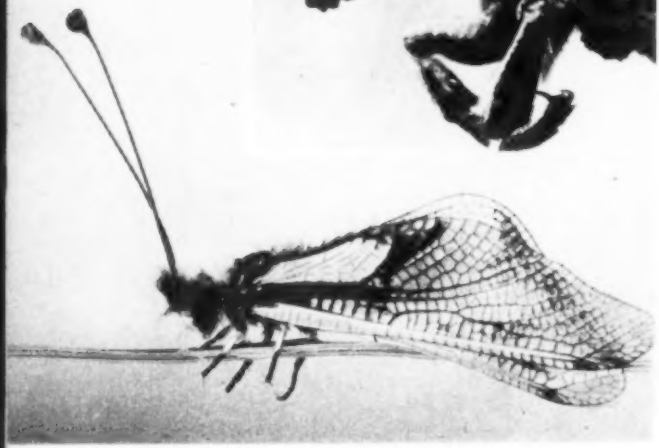


Fern leaves? Guess again—they're feelers on a silkworm moth!

MANY'S the occasionally hungry, occasionally lovelorn young man with a portable radio who should sigh in envy of the beetle or moth he can crush with a finger. Antennaed by means of his compact receiving set, he can tune in music or wirelessed information at will. However, the antennaed insects not only receive comparable broadcasts that way, but can learn the exact location, near or far, of a square meal and of a trembling, sweet and suitable mate! Obviously, antennae of such sensitivity are just what men with empty hearts and stomachs are waiting for inventors to perfect.

The analogy between radio antennae and insect antennae is really close—in fact, many entomologists incline to a belief that it is via

Coil-like antennae of the mandarin wasp (right) looks as strong as a horn compared to the thread-like feelers of the neuroptera (below).



The head-heavy Indian-Malay stick beetle below has jointed antennae 8 in. long! He consequently eats well.

wave lengths rather than as chemical matter that scarcely-perceptible traces of odor are received by the insects' antennae. Radio aerials, where the wave-receiving surface is increased according to its length, have a near-parallel in the insects' feelers. Long-spanned single-wire aerials correspond to the long, simply articulated, often thread-like feelers on many insects. In the case of certain "cavern locusts" which live in perpetual darkness in natural hollows, such single feelers often reach 14 inches in length. Close-in frame aerials also have their insect counterparts in the fan- or plume-shaped type found on many butterflies and beetles.

Men consider the dog's

[*Continued on page* 153]

Fan-shaped feelers of the miller (above) aid him with several sensitive surfaces.

"Living aerial" of this cyriopalus beetle resembles stalks of wheat—or a headdress for a Broadway show-girl!

WELDING— This War's Revolution

A science, an art, a toy, welding's great present is in building war machines quickly and strongly.

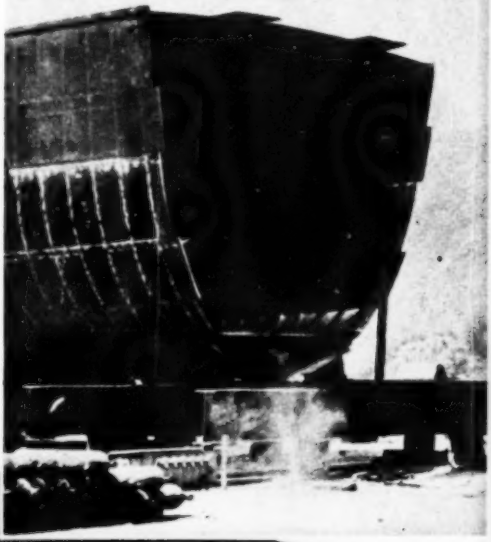
by Myron Weiss

Member of American Society for Metals, American Association for the Advancement of Science

A WELDER has just made himself an aluminum guitar which has a weirdly pleasant tone. He is Victor D. Thomas of Kent, Ohio.

A team of welders have just figured out an easy, quick way to remove broken stud bolts. They build up the broken shank with welding metal until they have enough metal above the surface of the work to get hold of with a wrench. These ingenious welders are William F. Kramer of The Bronx and Alex F. Morton of Brooklyn, N. Y.

Squads of welders are assembling pipelines that run across whole regions of the United States. They assemble pressure tanks for



Below: Six welders had the pusher head of a scale breaker back in service, 8 hours after a breakdown in a steel mill!

INS photo

Welding 173-ft. sub-chasers bottoms up, then turning them right side for finishing, Dravo Corp.'s new method, speeds production.

the refining of gasoline. They assemble army tanks, airplanes, ships.

Welding, indeed, has become a science, an art, a toy.

In your home workshop you can build and repair metal objects by means of welding.

You can have your own business by setting up a welding shop to repair broken machines in your community.

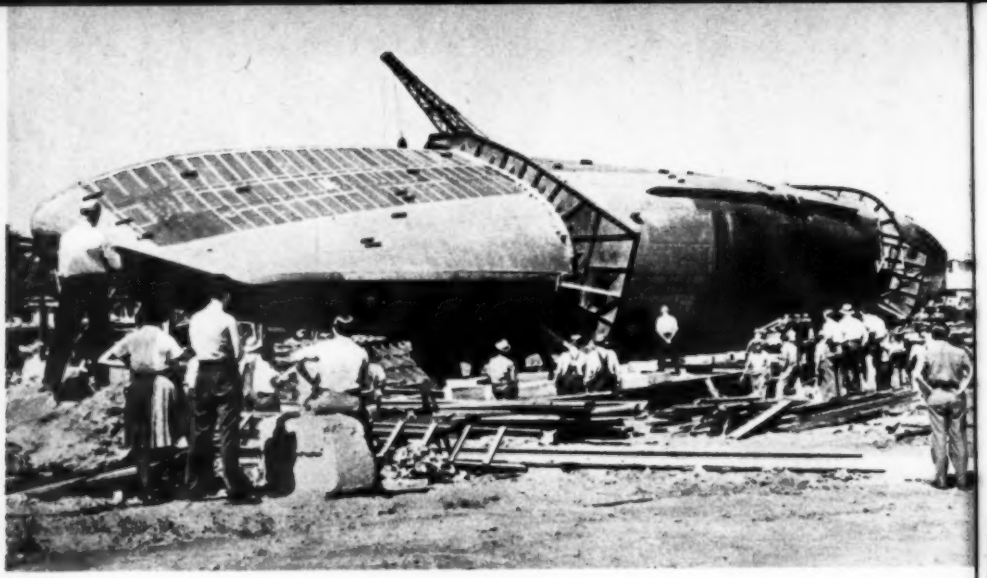
But the great present of welding lies in construction, especially in the construction of war machines and of the ancillary machine tools that build those war devices. This World War is making welding as commonplace in industry as the last, European War made riveting commonplace. Both processes of fabricating metal machines have, for the time being, made casting a relative subsidiary metallurgical procedure.

Yet a good casting may be a more useful thing than a similar structure put together by riveting or welding. So ingenious foundrymen are striving to catch up with their rival metal workers.

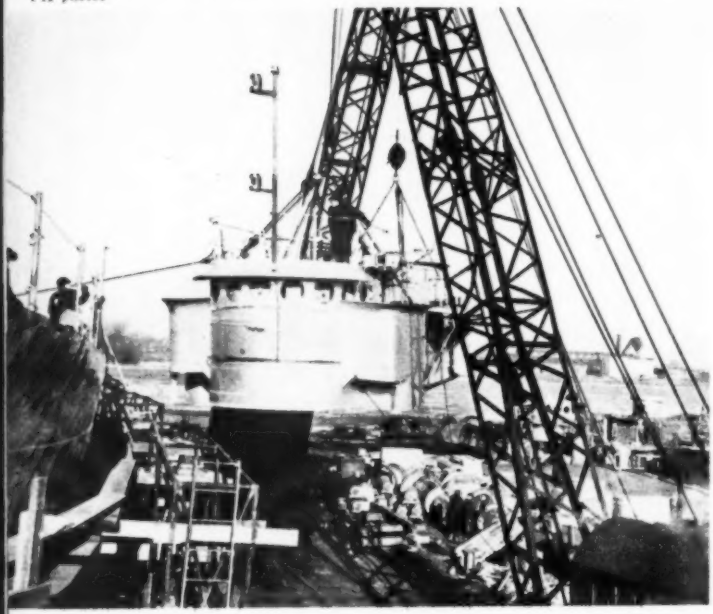
Nonetheless, welding is the most dramatic, the fastest, and the cheapest method of putting metal to work at the present time.

Background

The art and science of metal working now engages the attention of a learned society, the American Society for Metals (Dean Bradley



PA photos



Above: Braced, a welded sub-chaser hull is rolled into conventional position by the Defoe Shipbuilding Co., Bay City, Mich. Soon *(left)* the superstructure is swung into place. With assembly-line methods like these, one sub-chaser is produced a week, instead of each six weeks.

Stoughton of Lehigh University, president), and a technical organization, the American Welding Society (ordnance expert Col. Glen F. Jenks, president); supports the biggest industrial exhibition in the world, the National Metal Congress & Exposition (William Hunt Eisenman, director), which meets in Detroit next October; and sounds off through the most magnificent trade publication anywhere, *Metal Progress* (Ernest Edgar Thum, editor).

Yet it all began tens of thousands of years ago when primitive men found the rocks on which they built their fires melting into lead or tin or silver, into copper or gold. (Iron ore was first smelted about 400 B.C. in India, Ceylon and Japan.)

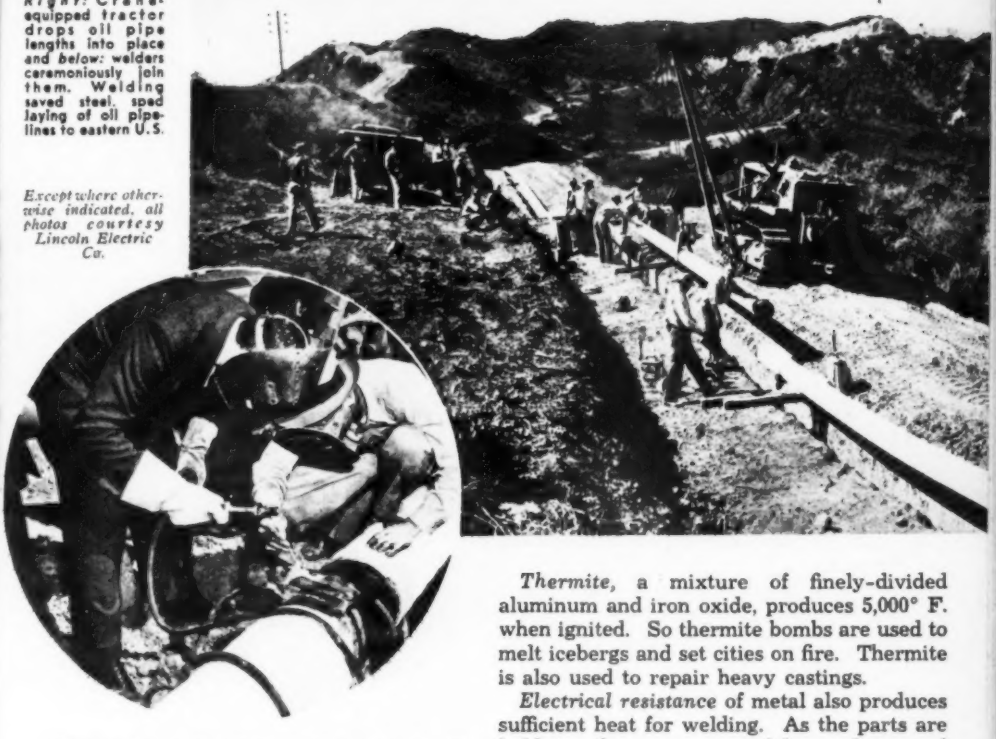
First metal working was the forging, or pounding, of metal pellets into shapes that primitive men could use, such as hammer heads, arrow heads, knives. The knives, forks and spoons you use to eat with are forged articles.

Next step for primitive men was to tie two forged pieces together and thus make something new and useful. For binding they used thongs, string, wire. Later they used metal clamps, bolts, rivets. Medieval armor was riveted just as ships and boilers and smokestacks are riveted in our generation.

Another old way of holding two pieces of

Right: Crane-equipped tractor drops oil pipe lengths into place and *below:* welders ceremoniously join them. Welding saved steel, sped laying of oil pipelines to eastern U.S.

Except where otherwise indicated, all photos courtesy Lincoln Electric Co.



metal together is to solder or braze them with another kind of metal which melts at a lower temperature than the work pieces. Solder metal fuses at a lower temperature than does brazing metal. The tops and bottoms of tin cans used to be soldered to the cylinders. Now they are crimped together.

Now if the smith heats two pieces of metal until they soften and squeezes them together, they then fuse just as though in the beginning he had cast or forged them in a single piece.

This, then, is welding, the joining of metal by heat and pressure.

Heats For Welding

Iron melts at some 3,000° F. and above. For welding you must apply such heat swiftly and accurately. Methods of attaining such heats are:

Fire in the blacksmith's forge. He can handle only small pieces in his forge and on his anvil, such as horseshoes.

Nonetheless, by adaptation of heating furnaces and power hammers large quantities of steel pipe and vast pressure vessels used to be joined through welding.

Thermite, a mixture of finely-divided aluminum and iron oxide, produces 5,000° F. when ignited. So thermite bombs are used to melt icebergs and set cities on fire. Thermite is also used to repair heavy castings.

Electrical resistance of metal also produces sufficient heat for welding. As the parts are held together a current of low voltage and heavy amperage is flashed through them. At that instant, while they are melting hot, the welder gives them a squeeze which fuses them permanently. There are several adaptations of resistance welding—butt, spot, seam, shot.

In butt welding the edges of the work are held together while the resistance makes them one. In spot welding the pieces overlap; electrodes grip them from both sides; the spots where the electrodes touch the metal weld to each other. If the electrodes are made in the form of wheels, they can roll along the overlapped joint and so produce a continuous seam weld. For those stainless steels which lose their special properties when heated moderately, high shot weld is used. This really is spot welding, but it uses a very strong current for so brief an instant that the steel is heated like a shot and only at the very spot to be welded.

Resistance welding is fine for mass production. Therefore it serves chiefly for making standardized parts of machines.

Gas welding utilizes the high temperature of acetylene burning in oxygen; or some similar combination [*Continued on page* 157]

You're RIGHT — That's WRONG

Here are 25 statements, some of them true, the others false. The trick is to separate the *true* statements from the *false* ones—and it isn't as easy as it looks! Use a pen or pencil and check the correct box under each statement and see how you make out! After you've given yourself the test, try it out on friends and other members of the family and compare scores. They'll enjoy it and so will you.

Are you ready? Let's go!

1. The original name for the "iron lung" used on paralysis patients was "Momsen lung."
   True ☐ False ☐

2. The bald eagle is not really bald, but gets its name from a patch of white feathers on its head.
   True ☐ False ☐

3. Haycocks are the type of ferocious chickens formerly used in cock fights.
   True ☐ False ☐

4. The term "clinker built" does not apply to the type of coal furnace having a cinder crusher in the fire box.
   True ☐ False ☐

5. Airport attendants know that prop wash is a strong solution of soap and benzine, used to clean propellers.
   True ☐ False ☐

6. Galena is not an Italian city famous for its olives, but on the contrary, it is lead sulphide.
   True ☐ False ☐

7. Prestidigitators are now required on all autogiros as regular equipment.
   True ☐ False ☐

8. Although helium has not as much lifting power as hydrogen, Navy blimps are filled with it because it will not burn.
   True ☐ False ☐

9. Although the horse is not as prominent in warfare as it once was, the Army still uses scallions to carry dispatches over extremely rough territory.
   True ☐ False ☐

10. The Peruvians long ago had some very valuable garden tools, as they made spades of gold and silver.
    True ☐ False ☐

11. Today, in 1942, there are more Indians in the western hemisphere than there were in 1492.
    True ☐ False ☐

12. Sherbet for dessert isn't a new idea—the famous emperor Nero made his own by adding fruit juice to snow brought to him from the Alps.
    True ☐ False ☐

13. Sea gulls are a valuable warning to defenders of England's coast, as they always fly inland ahead of raiding planes.
    True ☐ False ☐

14. Poisonous snakes are found in equal numbers in all areas of the United States except the South, where they are rare.
    True ☐ False ☐

15. An airplane needs from 86 to 180 pounds of rubber, but 60 used toothpaste tubes contain enough tin to solder all the electrical connections in a medium sized bomber.
    True ☐ False ☐

16. Safety pins are not a modern development, they were invented before the year 1,000 B. C.
    True ☐ False ☐

17. The toy bear in the playroom looks friendly enough, but the grizzly bear is the most ferocious animal in North America.
    True ☐ False ☐

18. Giant sea turtles around the sea beaches of Florida never lay their eggs except in extremely bright sunlight in January and February.
    True ☐ False ☐

19. Although the common variety of garden worm is thought to be slow and sluggish in its actions, it often bores through the earth at more than 70 miles an hour.
    True ☐ False ☐

20. Before man developed speech he knew how to laugh, and did so to signal other members of his group that it was safe to relax, or that danger was not present.
    True ☐ False ☐

21. A rhododendron is a small modern dinosaur which lives in the warm caverns of Glacier National Park.
    True ☐ False ☐

22. With or without tracks, no war tank has ever traveled faster than 60 miles an hour.
    True ☐ False ☐

23. Adult male gorillas are no lightweights, as they may weigh as much as 600 pounds.
    True ☐ False ☐

24. Although the daily newspapers seem to be constantly telling of auto accidents, 130 cities were without a single traffic fatality in 1941.
    True ☐ False ☐

25. On shipboard a lubber line is a procession of landlubbers seeking employment as seamen.
    True ☐ False ☐

WHAT'S YOUR SCORE?

To get your score simply give yourself 4 points for every question you answer correctly and total the result. If your mark is above 90, you are exceptional; if it is between 80 and 90, you deserve high praise; if it's between 70 and 80, you're good; between 60 and 70, fair; and below 60—well, try again next month!

Answers will be found on page 168

NEWS OF SCIENCE AND MECHANICS

PLYWOOD LIFEBOAT
SECRET RADIOING
TEST-CRUSHING
SIX-ROW PICKER

To Save Metal, Plywood Lifeboats Will Ply Waves

TESTED and approved by federal officials, this trial plywood lifeboat—first of its kind—may be followed by many others to replace conventional steel lifeboats weighing 2,500 lbs. A third stronger, holding the same number (31) of men, the plywood model weighs only 1,700 lbs., using but 150 lbs. of steel. Designer: L. S. Baier of Sunderson Brothers, Portland, Ore.

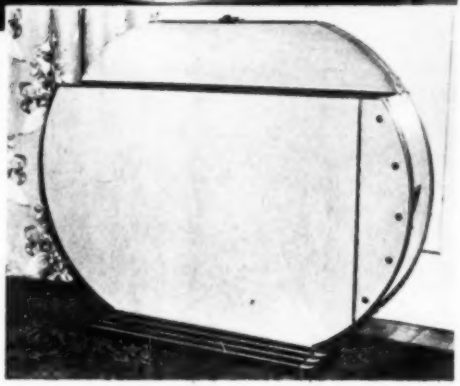
Whittlers' Bike

FATHERS adept at whittling and woodworking may be able to make bicycles they can't now buy for their children due to metals priorities. Here are Marlene Mains and Darryl Hickman on a wooden bike held together by three metal bolts. Tires are of reclaimed rubber.

A Los Angeles designer worked it out with plywood, not yet affected by priorities. Adult sizes next. (See next month's issue!)

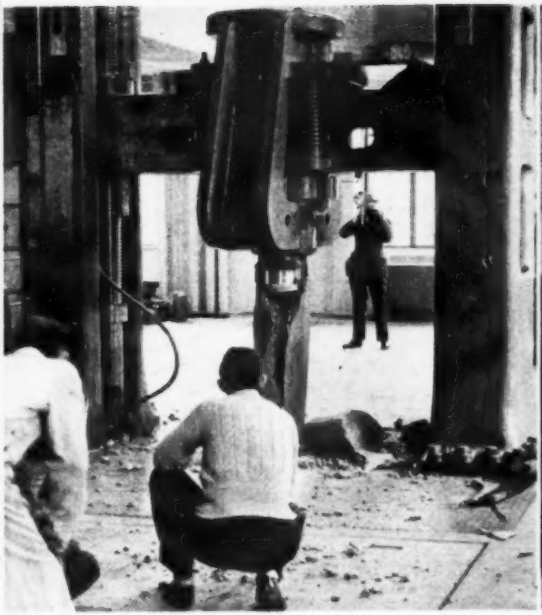
It's All Done With Magnets

BAND-LEADER STANLEY DeWAAL'S pianist wife became a vibrachord player overnight when to a vibraharp he added an electric resonator system and a set of 30 electric magnets to strike the 30 metal bars. Each key on the board electrically controls one of the magnets. The result, built by hand in two months spare time for $600, is a new instrument which may be regularly produced. It can be folded up, as at right, for the convenience of traveling bands. It replaces a vibraharp or vibraphone in an orchestra.



Spiraling Radio Waves Permit Secret Talk

A NEWLY - DEVELOPED radio transmits a spiral wave which can be turned either right or left by the operator, and receives from either direction. The advantage thus obtained, secret communication between points, is not true of any other radio set! Inventor J. H. Hammond, Jr., nearest radio, has offered it to the government.



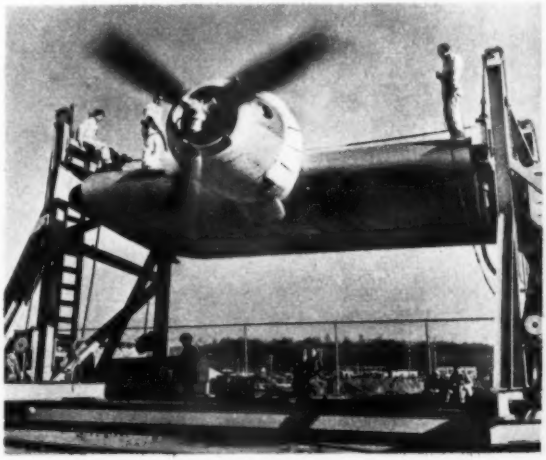
Test-Crushing 18-in. Concrete—Or Eggshells!

HAVING the largest transverse testing capacity of any machine in the world, this 2½-story tester has just been installed at Northwestern University. It can exert a pressure of 1,000,000 pounds on a beam 55 ft. long, yet is so accurate it'll measure loads to an accuracy of 1/10 of one per cent. Crumbling this 6-foot high, 12-in. concrete post was just an easy workout—the column fell apart at 505,000 lbs. pressure. The recording device, right, which marked the point at which each stage in the test was reached, can also draw stress-strain graphs of objects tested for distributed or twisting loads. If there was one, a beam 7½ ft. wide and 18 ft. long could be put in the machine and yanked apart!

Chicago-area defense manufacturers are using the testing machine in research.

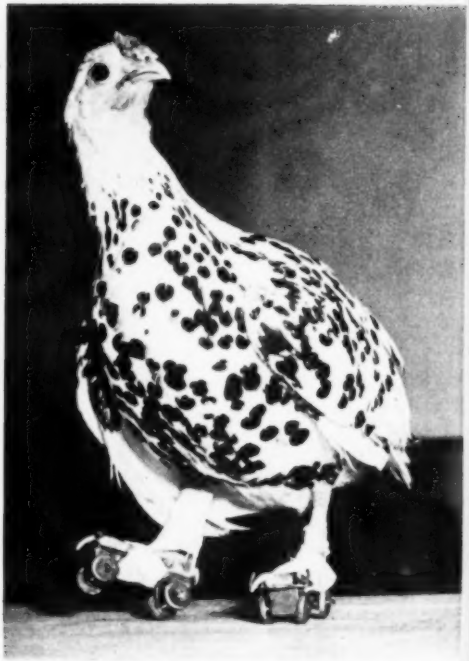
Wing Flies And Flies, But Never Gets Anywhere

THIS motor mounted on a wing-section roars and roars, but never leaves the ground. It's attached to a house in which is located the control board, operated by Boeing researchers. Mounted on wheels on a circular rail, the whole works is changeable as the wind, so that engine installations of new-type planes can be tested in consideration of wind cooling, and under the severe conditions of warm-up and take-off.



Stick 'Em Up, Shark!

SEA divers now have effective protection against sharks in a 2,200-pound pressure pneumatic gun that can fire a sharp-pointed steel dart. The single missile is fired only as a last resort; usually, since a shark pursues anything that moves, a discharge of air will send the man-eater chasing bubbles.



Ever See A Wheeled Hen?

JAUNTILY cutting a corner, Spots, the Gay Hen, keeps a sharp eye out for possible escorts around the rink, the while matter-of-factly showing off her skating technique. She's one of several fowls George Plitt of Rohoboth Beach, Del., has trained to skate, and to play dead even when a car is not in sight.

"Tire" Means Riding On Springs Twice

THIS substitute tire was made by Floyd Bradford of Portland, Ore., who cut auto spring leaves into 30 pieces and bolted them in two rows to an old tire rim. A separate shoe made from tire casing pieces is attached to the end of each section for traction. The "tire" can be driven 50 m.p.h. safely, the resiliency of the spring steel providing smoothness. Awful noisy, though.

Highways Squeezed Out Like Toothpaste

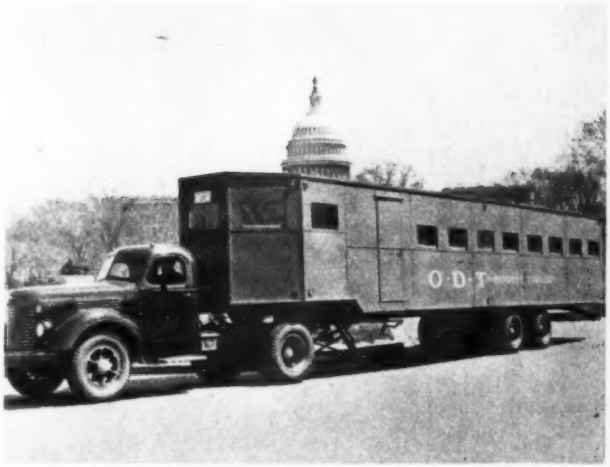
ALMOST as easily as you squeeze toothpaste onto a brush from a tube, this machine spreads and finishes the concrete for a new road. Replacing a crew of men who'd laboriously spread, level, and smooth the cement, the machine moves along on the metal rails set as the highway strip's boundaries. Such mechanization is reducing road surfacing costs sharply.

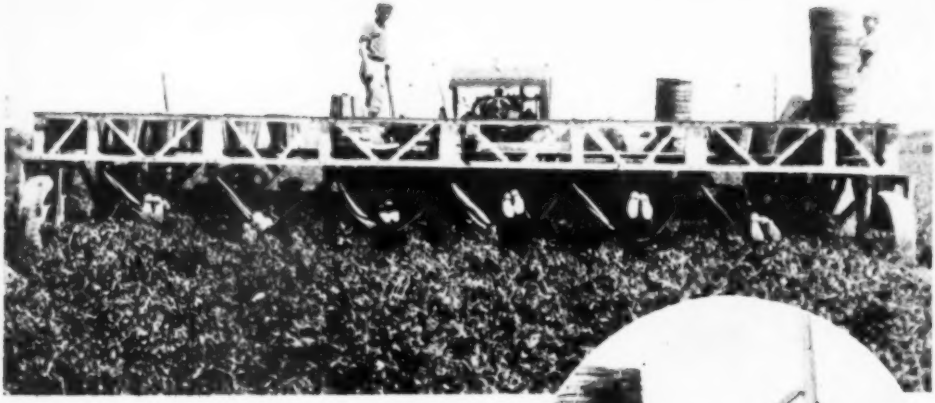
Diplomat Cripps Is A Workshopper

BEFORE his present British war cabinet duties prevented, Sir Stafford Cripps spent much spare time in his special workshop at his home in the country. Here, with shirt open and sleeves rolled up, he's putting finishing touches on a chair seat. His bench is almost as well fitted with carpenter's tools as an MI Workshopper's, eh?

Bus Could Trailer Truck 141 To Work

BECAUSE it requires few critical war materials to make, this oversized bus trailer for 141 persons may be recommended by federal officials to industrial sections where workers' transportation is a problem. Its use will save numerous autos' tires and gas, and reduce traffic. Of plywood and masonite and 45 ft. long, it contains four-person wooden benches with an aisle along one wall.





SIX-MAN MACHINE MASS-HARVESTS TOMATOES

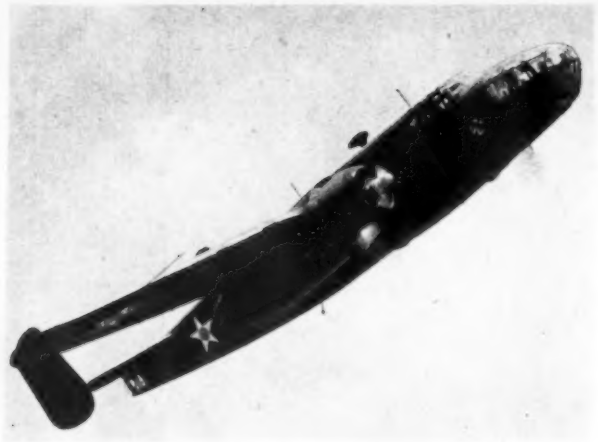
SEVEN rows of tomatoes are picked at a time by six workers suspended in canvas hammocks (note protruding feet above) on this self-propelled machine built by Frank Bucher of Lititz, Pa. Pickers (see right) put the ripe tomatoes on a belt moving in front of them to their sharp-eyed boss on the platform overhead, 45 inches above ground. Built ingeniously but cheaply of discarded parts and an old auto engine, the harvester has chain-driven front wheels. Rear ones run free. Each front wheel has a clutch; tightening one, by a pull on a rope, steers the outfit (below). Labor shortages and war demand for nutritious tomatoes accent its importance.

Army Eyes Leave Trees To Ride "Grasshoppers"

ARMY artillery observers have climbed down from precarious perches in trees and balloons to aid gunners correct range and elevation from small, big-windowed planes called "grasshoppers." Unarmed, they keep well behind their own front lines, voice-radioing their observations. Above, mechanics check a motor in a sand-shedding tent at Fort Bragg, N. C.

Beep-beep, Make Way For The Peep-Jeep's Cousin!

LATEST in the eep-series of army vehicles is cousin to the ubiquitous peep and jeep—the beep! Elaine Gunderson, a secretary at Gowen Field, Boise, Idaho, is here taking a package from her beep's carrying box for Technical Sgt. James Ladd. Officially known as an auto-glide scooter, the beep's the army's answer to rubber and gasoline shortages as it needs little of either. It takes only three tires and they're small, and will go 40 miles on a gallon of gas with its tiny below-seat motor. Beeps are not for speeders, though—top speed is 25 m.p.h.

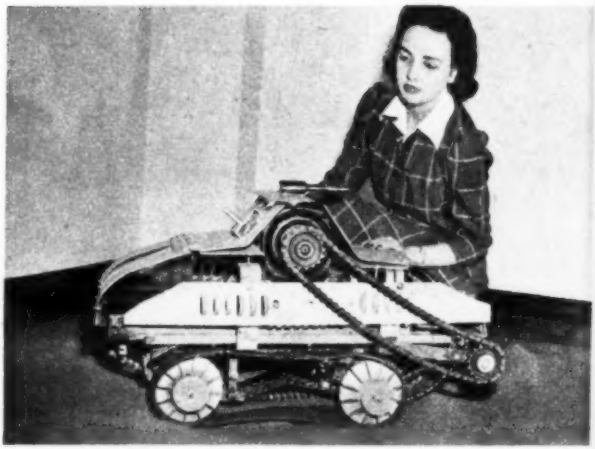


Bomber's Nose, Tail Are "Flying Greenhouses"

LONG range, large bomb capacity, and 300 mi. speed from two Wright 1,700 h.p. Cyclones make this mass-produced North American B-25 medium bomber one of the most powerful Air Corps elements. (A close-up of the bombardier in its greenhouse-like tail is shown on the cover.) To aid highest tactical efficiency of the five-man crew, the B-25 has extensive provisions for comfort.

Tank Spits Out, Takes Up Its Own Bridge

MISS CATHERINE ALLEN inspects model of a new, powerful tank good for quick thrusts over all kinds of terrain. It's equipped with an unusual feature inside—a bridge which can be ejected from the tank's front when a narrow stream is reached, enabling the tank to go over instead of through the water. After the crossing, the bridge is drawn into the tank through an opening in the rear



Here's That Jeep Again! Now It's A Water Baby

NEWEST variation of the versatile, nimble jeep is the "aqua cheetah," an amphibian personnel carrier not yet adopted by the Army but being tested at Fort Knox by the Armored Force Board. Here leaving the water after a successful swim, the bug-eyed, broad-snouted vehicle is ready for a cross-country run, power having been shifted from propeller to wheels. Soldiers have dubbed it the "sea jeep."

Trainers Unite Nations, Too

UNITED in all-out effort against the Japanazi forces, members of the United Nations agree on the kind of trainer plane to be obtained from the Arsenal of Democracy for developing their future pilots. Observe the identifying markings on these five Boeings as they fly side by side for Peru, Great Britain, China, U. S. Navy, and U. S. Air Corps.

Meet Ma Bomb And Bomblets

PONDERING ways to increase the destructive possibilities of the limited number of bombs which a plane can drop, an inventor has devised a "mother bomb" with a regular family of small bombs which on impact will scatter in all directions. Ma Bomb will not only dig a big hole in whatever it falls on, but her bomblets will be responsible for five smaller areas of chaos roundabout.

Well-Lettered Plane Shows New Materials

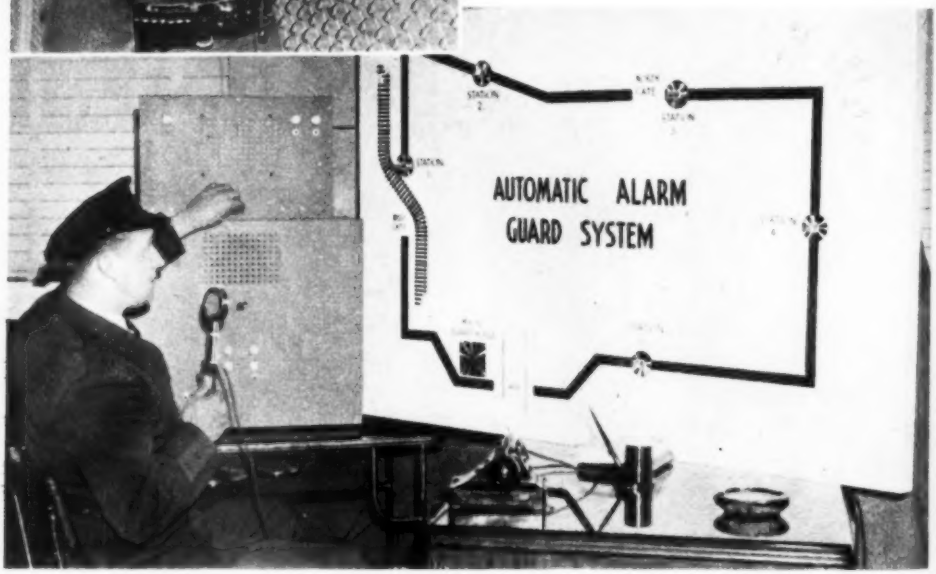
LETTERING on this photo of an advanced trainer tells how priority-precious metals may be replaced by wood and low-alloy steel—more, the plane can be produced faster, maneuvers better, and costs less! Similarly, a mammoth transport plane to be made mainly of plastics and plywood may solve another air arm problem: spacious, speedy units to take soldiers and equipment to combat areas.

Jerry May Lie, But Not Tommy's Camera

WHEN the Jerries lie about the number of their planes, supply ships, or E-boats that escaped the Tommies' four-cannon Hurricane fighter planes, movies showing the destruction of claimed escapes frequently give the lie to their statements. Here's the camera which, synchronized with the firing of the cannon alongside, records the hits irrefutably.

Listening Fence On Duty

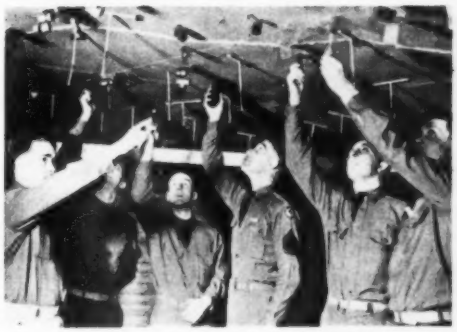
THE duPont Company guard at left isn't talking into the air, he's reporting to the main office (below) via the plant's listening fence. Yes, sir, it picks up his voice and transmits it by the small square robot. More, it'll flash the alarm if anyone tampers with any part of the miles of high wire fence, by causing a light to glow on the map-like chart of the plant grounds in the guards' headquarters. The light shows just the point where the fence heard a possible saboteur.



STUDYING TANK TACTICS WITH TOYS

TOUGH, burly student officers who thought their toy-playing days were past are shown above earnestly watching toy soldiers, artillery, and tanks like those in the lowest photo. The miniatures are deployed over a section of English countryside, in a 24 by 28 foot canvas replica flown to the United States in two sections that now occupy two rooms at the Armored Force School at Fort Knox, Ky.

Remarkable similarity to war strategy is provided because the tiny troops and weapons are moved over the surface by five men stationed beneath the canvas, acting to contact spots designated in the problem recited by the instructor. As the center photograph shows, magnets in the men's hands are used to maneuver the metal soldiers, field guns, tanks, and motorcycles on a 20 m.p.h. scale. The magnet-man at the right in the photo simulates the laying down of a barrage of artillery fire on the terrain above him by means of a puff of cigarette smoke from a syringe. Guy wires under the canvas support upright sticks to reproduce the rolling knolls, with the roads, streams, and farmhouses of an 8x13 mile section of Salisbury, Wiltshire, England.



Cobra Made Deadlier With Extra Fuel Sac

BY LENGTHENING the time the Army Bell P-39D Airacobra can remain in the sky, the extra belly tank shown on the new model here makes this U. S. fighter even deadlier. Designed to augment the normal fuel supply, the sac can be dropped in flight when the gas is used; it's the only visible change over earlier types of this heavily-cannoned fighter.

Snow's No Worry To Ski Peep, Autoboggan

RIGHT into early summer, U. S. Army troops on Mt. Rainier, Wash., contend with snow in field training, using unusual equipment like the propeller-driven peep on runners, at left, and the motorized toboggans below. Both go at amazing speed. Their riders are trained in skiing, snow-shoeing, mountain-scaling, parachuting with skiis, and alpine fighting.

Will This Ray End War?

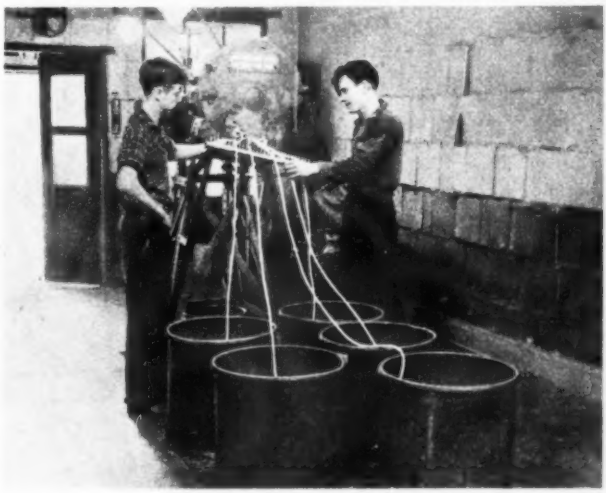
WPB has "frozen" the female silhouette for the duration—but that will be brief, Carlo Gallerani of Bridgewater, Mass., above, says. His ray gun when perfected will "freeze" enemy battleship and plane machinery, ending the war at once by "projecting electronic rays to immobilize engines."

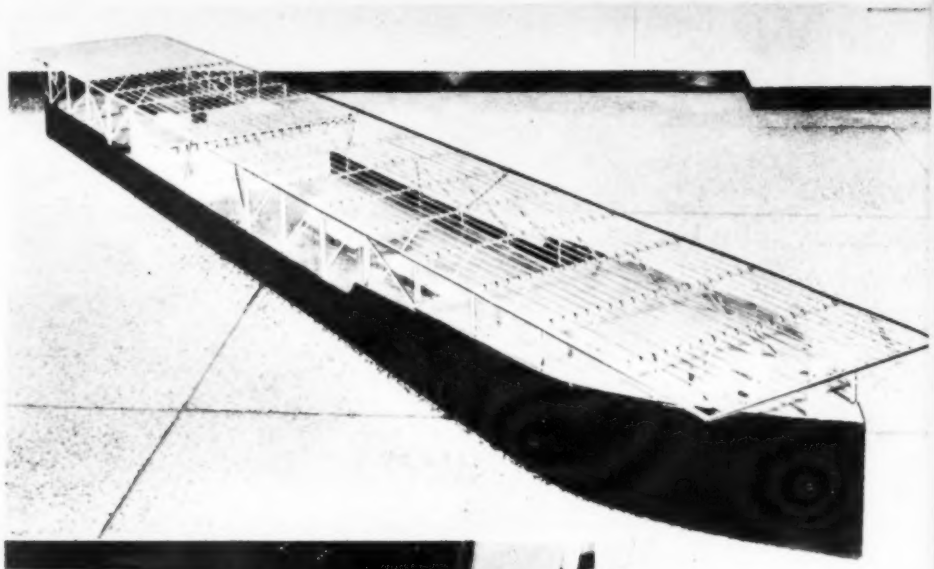
Really Less Tiring, Men!

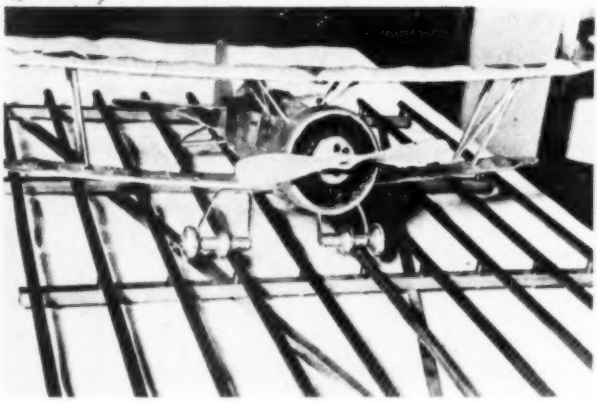
THE new pack developed for the U. S. Marines and now in mass production, shown above in profile and rear views, is an all-purpose carrier said to be less fatiguing to carry. It's lighter, and has a new method of suspension so that weight is carried high on the shoulders.

Cannon Prefer It Without Tomato Sauce

MACARONI? No, though it is food of a sort—cannon fodder! The white lengths are smokeless gun powder in macaroni-like form being fed into a machine for cutting into designated lengths. Then it'll be loaded into powder bags for artillery charges. Smokeless powder forms the charge which propels projectiles (shells to you) from cannon. This is one of the activities at the army ordnance arsenal.







Lattice Of Tubes Would Make Carriers Of Ships

MERCHANT ships could be converted to aircraft carriers with a proposed open deck of parallel tubes as on model shown here. Planes would have wide-tread, wheel-and-roller landing gear to prevent their settling between pipes regardless of position on landing. No slipping off, either.

Dies Are No Dice With These Three New Tools

DIES aren't needed with these three new metal-working tools, all hand-operated. Useful where only a few duplicate parts are necessary, they're proving time- and money-saving in many defense plants. Consisting of midget shears, brake, and bender, they are flexible to accommodate of various shapes and sizes are accurate to within a .001-in.

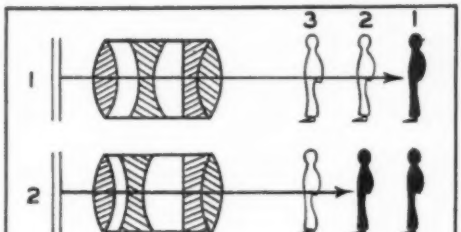
COMING: UNIVERSAL FOCUS FOR ALL STILL CAMERAS

How the oscillating lens will be adapted to still photography too, in the future.

by Louis Hochman

CONTRARY to general belief, the principle of the Electroplane "shivering lens" movie camera, described on pages 44 and 45 of the May MECHANIX ILLUSTRATED, can be applied to *still* photography. P. Stanley Smith, co-inventor of the Electroplane camera with the late Dr. Ludwig Dieterich, has granted MECHANIX ILLUSTRATED this exclusive interview with the purpose of clearing up the popular misconception about his revolutionary invention.

The night scene, above, was taken with a wide-open oscillating lens—enlarged from a 35mm movie negative frame—combining maximum lens speed and infinite depth of field.



This diagram illustrates the operation of the oscillating lens as applied to still photography. The central double-concave element of the oscillating lens travels through a distance of .012 inch; a single movement of the oscillating element will reproduce all planes in the field sharply. In each of the cases above, the furthest figure represents an object at infinity and the nearest figure an object at the minimum focusing distance of the lens. With the oscillating lens as far forward as it goes (1) the object at infinity is sharply rendered; as the element moves in its .012-inch course, the various intermediate planes (2) and the object in the foreground (3) each become sharp in turn.

As described in the May issue, the Electroplane camera lens has one interior element in its structure which oscillates within the lens mount at a rapid rate under the influence of an electric current. This endows all resulting motion pictures with unlimited depth of field, even though the lens is used at its widest aperture where minimum depth of field can be expected.

The Electroplane camera is now being developed by the Smith-Dieterich Corporation which was formed by Mr. Smith and Dr. Dieterich and which is now headed by Mr. Smith. Although its universal focus principle was primarily designed for motion picture work and the first working model was

An "impossible" setup shot at full aperture with the oscillating lens. Near, intermediate, and distant planes—all are sharp.

adapted to the Mitchell motion picture camera, Mr. Smith and his associates state that there is no reason why it shouldn't be equally effective when adapted to still cameras in the future.

Unfortunately, the war is temporarily preventing further progress in the construction of oscillating lenses for any purpose. But the Smith-Dieterich Corporation is going ahead with its research and calculations—computing the lens on paper for the day when victory permits its manufacture on a commercial scale and its adaptation to still photography.

According to Mr. Smith, it will be possible to compute and produce oscillating lenses of practically any focal length, and of any type: Tessars, Xenars, etc.—even telephoto lenses! The outstanding feature of the lens is its oscillating element, a single lens within its structure which travels back and forth during the actual exposure at the rate of about 13,200 oscillations per minute. It traverses a distance of only 3/10th millimeter (approximately .012 inches).

Minute as these excursions may be, they influence the entire function of the lens, keeping it in sharp focus on all objects situated from about four feet in front of the camera to infinity! Furthermore, states Mr. Smith, the .3mm. excursion of the oscillating lens element is the one thing that remains constant, regardless of the focal length of the lens to which it is adapted.

Although the present "shivering lens" mounted on a standard Mitchell motion picture camera, is operated electrically by an involved system of electrical controls, the inventors claim that, in adapting it to still cameras, a simplified mechanical arrangement may be incorporated into the camera's shutter mechanism to set the lens element in motion at the precise time of exposure. A single excursion of the lens across its field during the exposure is sufficient to obtain the universal depth of field characteristic of it. The oscillations may eventually be worked electrically from batteries instead, depending upon which method the inventors find more practical and efficient. Large studio cameras will probably be operated electrically from house current.

Mr. Smith visualizes the Electroplane Camera of the near future as one having no bellows or rack and pinion focusing mount. Since the lens produces universal focus, there will be no need for manual focusing, coupled rangefinders, etc. If, however, it is desired to use the camera as an ordinary focusing type to get blurred backgrounds, focusing will be done by stopping the oscillating lens element at a point where it will cause the

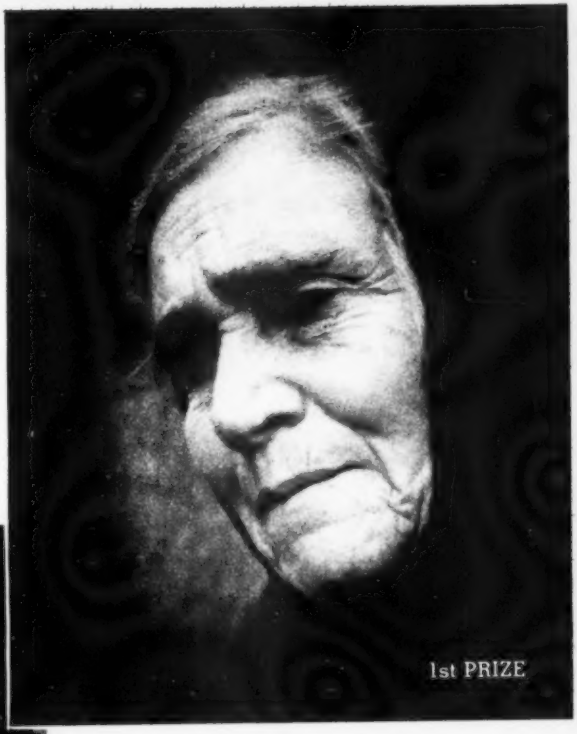
[*Continued on page* 155]

With the oscillating lens, it will be possible to expose so that all planes are sharply focused—as well as to focus differentially for the foreground, middle distance, or background. The moving element is merely stopped at the proper distance.

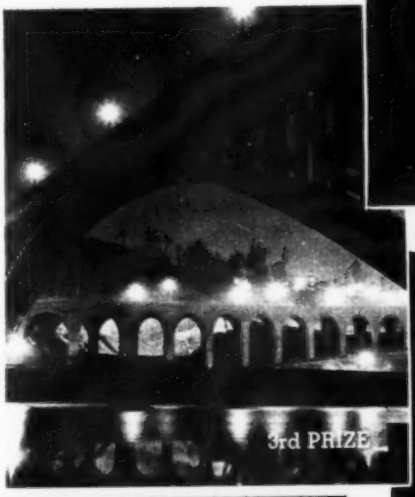
PHOTO CONTEST

FIRST PRIZE ($10.00): "Refugee" by Marvin Brooks, 300 Central Park West, New York, N. Y. Rolleiflex camera, f/8 and 1/250th sec., on Super XX film. SECOND PRIZE ($5.00): "Post Office Patriots" by H. Horsfall, 388 Ashland Street, North Adams, Mass. Taken with a 4x5 Watson View Camera on Panatomic X, in D-76; f/11 with two, No. 16 photoflash bulbs. THIRD PRIZE ($4.00): "Harlem River Nocturne" by Arthur J. O. Romero, 99 Metropolitan Oval, Bronx, New York City, N. Y. FOURTH PRIZE ($3.00): "Hiya Babe" by J. P. Neil, 190 Jameson Ave., Toronto, Can. Taken with a 9x12 cm. Zeiss Ideal camera, on Agfa Supreme; f/16, 1/200 sec. with Kalart gun, No. 16 photoflash lamp at 15 feet.

Submit prints for this monthly contest unmounted—no larger than 8x10 inches. Print your full NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. With each print, list your camera, film, lens opening and shutter speed, illumination, and developer. Be sure to enclose return postage if you want unused prints returned. (Published prints can not be returned.) Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.



1st PRIZE



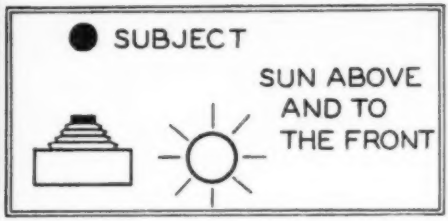
3rd PRIZE

2nd PRIZE

4th PRIZE

UNDER THE

Above: This is typical of the harsh portraiture that results from shooting in full sunlight at high noon. The diagram to the right of the photograph illustrates the relative positions of sun, camera, and subject. Note how the nose acts as a sun-dial.



by S. J. Ressetar

OUTDOOR lighting is taken so much for granted by the beginner that he generally shoots away quite unaware of whether the light comes from front or back, one side or the other. And the results generally tell the sad tale.

The snapshooter, probably makes his biggest blunder when he attempts to shoot outdoor portraits under the mid-day sun; to be more specific, the hours from 10 a. m. to 2 p. m.

During this period, the sun is brilliant and sparkling stuff, no one can deny. It fills the senses with a scintillating visual sensation. No wonder it tantalizes the beginner into the erroneous belief that it is the very essence of glamorous picture lighting. Don't you be fooled by the mid-day sun. That sparkle is a snare for the unsuspecting and uninitiated. The trouble is not in its sparkle, however, but in the fact that its position is all wrong—if you don't know the answers.

Directly overhead, the sun casts deep dark shadows under eye brows, nose, mouth, chin, and cheeks. The inevitable result is a conglomeration of conflicting shadows and highlights battling all over the picture area.

What to do?

Now, it would be mighty convenient to be able to move the sun a little to the right or left, up a little, or down, just like a photoflood.

Left: Begin modifying the angle of the sun by placing the model in a semi-reclining position. Her leaning forward or back, to the left or the right at different angles to the sun will create a variety of effects. But, avoid strain.

MID-DAY SUN

That's an idle dream, of course. But it's no reason to wring one's hands in despair. When confronted with the task of shooting a portrait when the sun is high in the sky, we do the next best thing to cajoling the sun into position. We move the subject into position.

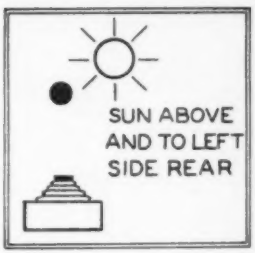
To begin your attack, place the subject out in the open facing the sun. Describe an imaginary circle with the subject in the center. With your camera in hand, proceed to move about the circumference of this imaginary circle and have the subject pivot about facing you, as you move either to the left or right. Watch the resulting effect on the shadows and light-splashed areas of the face. Try having the model stand up or sit down, then lean a little to the right or left or even slightly backward or forward. Just be careful to avoid facial and bodily contortions. In maneuvering the subject around, watch the background for distracting details, etc.

It is a good idea to use a lens shade for this and all other outdoor work. In following your subject about the circle, you probably will find yourself flirting with the sun out in front of the lens, particularly [*Continued on page* 155]

Above: The harsh overhead sunlight has been modified by placing the model in a reclining position so the sun strikes her face at a 45° angle. The sun is a bit trying in this position, but it permits of full lighting despite the model's wearing a wide-brim hat.

Above: A simple turn of the model's head, after shooting the illustration at the top of the page produced this interesting effect. The sun strikes the side of the face and does not try the subject's eyes. Turning the head still further in the direction of the camera produces an even subtler and more pleasing effect.

If the subject has an interesting profile a beautiful cameo effect can be produced under bright noon-day sunlight.



DARKROOM CABINET --ON CASTERS

by Gustav Gerlach

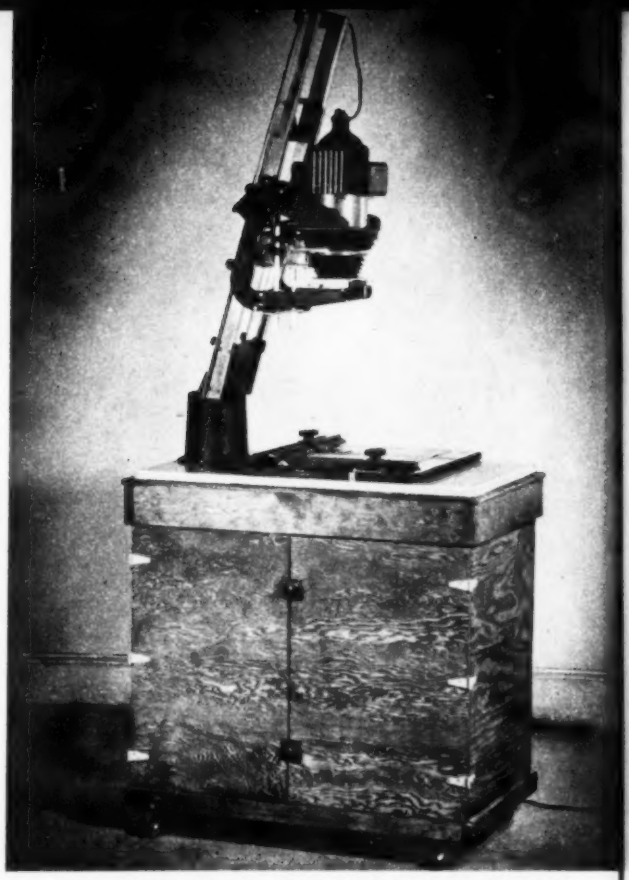
THE cabinet described in this article serves as a rigid support for the enlarger and provides storage space for all materials necessary for negative developing, contact printing, and enlarging. In addition, it incorporates a light-tight changing box which permits film holders and developing tanks to be loaded in complete safety at any time of day.

The caster feature enables the operator to use the cabinet and its contents in any part of the work-room, studio, darkroom or bath room where it serves to best advantage.

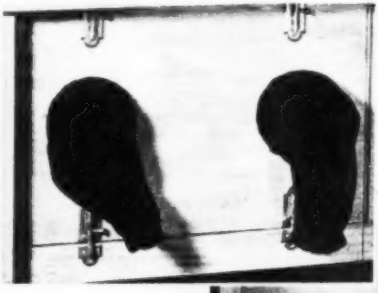
The following easily-obtained construction materials are needed:

12 feet, 2 x 2-inch pine
28 feet, 1 x 3-inch pine
1—6 x 8-foot panel of ¼-inch plywood
12 feet, ½ x ½-inch pine strip
1½ yards, black rubberized cloth, 24 inches wide
Box of 1-inch brads
1 pound, 2½-inch finishing nails for the framework
4 casters
4 small sliding bolts
2 small brass hinges, 1 inch wide
6 ornamental hinges for the doors
2 small door catches

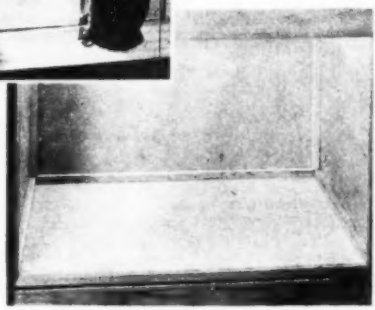
The first step in the construction of the cabinet is the building of the framework. The corner posts are 2x2-inch pieces of pine, 31 inches high. At the top and bottom side of each pair of the corner uprights, securely nail or screw in place a piece of 1x3-inch pine 17 inches long making sure that the corner posts and side pieces are squared up



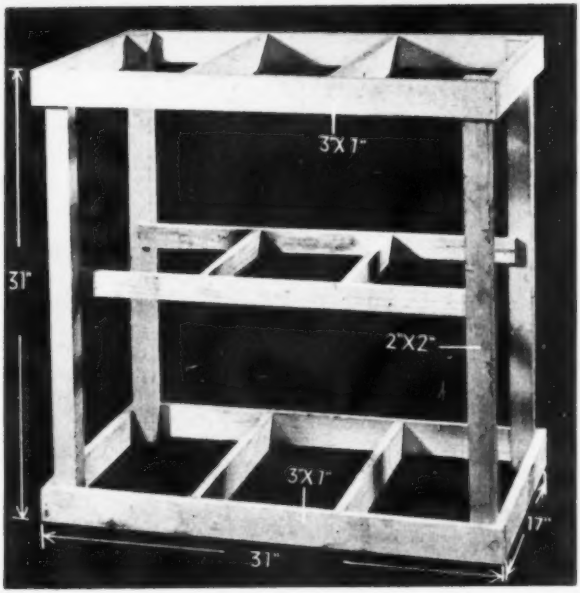
Here is the completed darkroom utility cabinet with the enlarger held in place by its own weight. The hinge and latch arrangement permit the two doors to be opened, to gain access to the storage shelves and changing box, inside.



Left: Front panel of changing compartment is held in place by four slide-bolts — the fixed ends at bottom fasten to the stretcher; the fixed ends at top fasten to a strip of 1 x 3-inch wood running between the braces across the top of the framework.



Right: All joints inside of the changing compartment are covered by ½ x ½-inch strips. The interior is painted a flat black to minimize the possibility of fogging.



Above: The cabinet framework, marked with the dimensions of the various pieces of lumber required. *Below:* Interior of the cabinet, as it appears when the hinged doors are swung open. All enlarging materials are kept together.

properly. The pieces that are fastened to the posts to complete the framework on the longer sides are also 1x3-inch pine, 31 inches long.

When putting these longer side-pieces in place, fasten them so that the end of the longer side-piece is flush with the outer edge of the shorter pieces. At two points between the long side-pieces, nail pieces of 1x3-inch pine to further strengthen the frame.

Following this, put a pair of stretchers along the length of the cabinet and nail them in place on the inside edges of the corner posts at a point half the height of the corner posts. The framework will now appear as in the dimension illustration-left.

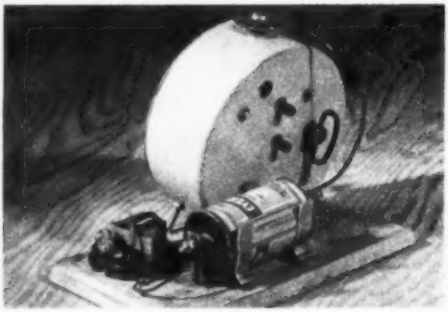
These stretchers act as a support for the shelf that is to be placed in the center of the cabinet. It is best to install the shelf at this point and also to run another shelf along the bracing members fastened across the framework at the base of the frame. These shelves are made of ¼-inch plywood and are cut 17 inches wide and 29 inches long. The corners of the shelves are notched to fit the corner posts.

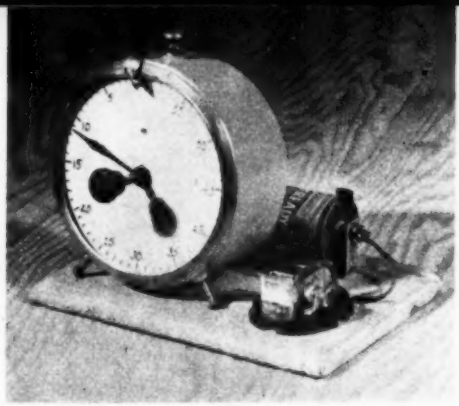
When inserting the shelves, put the lower one in first, supporting the shelves at the corners with small cleats cut from the 1x3-inch lumber; nail the cleats to the corner posts.

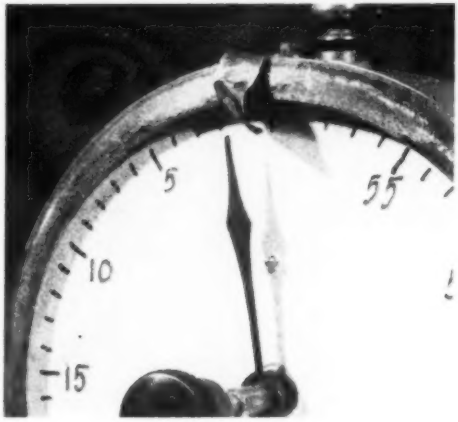
The next step is to erect a vertical dividing wall in the upper half of the cabinet so that a compartment 20 inches long is made at the left of the framework—the 20 inches being measured from the inside edge of the corner post at the left. This wall is made of ¼-inch plywood and is held in place on the shelf with ½x½-inch square pine strips nailed to the shelf on both sides of the wall.

Next, run a similar wall along the inside edges of the two corner posts at the left; [*Continued on page* 171]

PHOTO SHORT-CUTS







ELECTRIC INTERVAL TIMER. This handy apparatus is improvised from a modified kitchen clock, a buzzer, and a battery clip—all mounted on a wooden baseboard; the clock shell is fastened to the baseboard with a wood screw from its inside, and the switch (brass strip making contact with the minute hand—right), the buzzer, and the battery are wired in series. First, discard the glass of an alarm clock (in working order) and its hour and alarm hands, too. Remove the clock works, and draw a new clock face on the back of a discarded print, tracing the minute divisions very carefully from the original face and calibrating them counter-clockwise. Glue this over the original face and then slip an extension on the front of the minute-hand shaft by boring a brass sleeve to a press fit; insert a short rod in the sleeve and add a radio knob for easy adjustment. Cement contact switch to the case and rim of clock, insulating with paper and bending it to touch tip of minute hand at "zero" mark. Solder end of wire to this switch and lead it to the battery clip at the rear. Connect the buzzer (from a question-and-answer toy) in series and ground buzzer to one of the bolts holding clock works in case. *George D. Jones.*

Left: A coat hanger, hooked to the picture molding of a room makes an excellent "anchor" for a clamp-on reflector unit when the latter is to be placed high. *Wm. Swallow.*

Right: When picture taking on the studio work-table required the use of a glass background plate or screen, the job may be facilitated by supporting the glass with a pair of Agfa cut film containers, slit the thickness of the glass as shown in the illustration. *Louis Hochman.*

Below: One of the most effective tools for embossing or plate-sinking the border of a photograph is a glass, drink-mixing stick. To avoid any possibility of breakage, cover the upper part of the rod with a strip of rubber tape or some rubber tubing. *Kenneth Murray.*

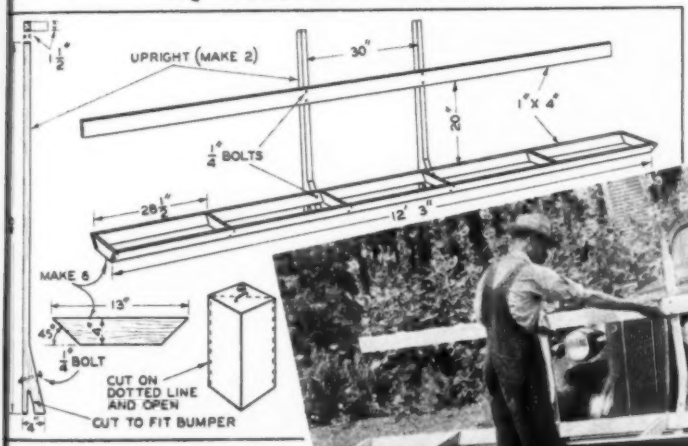
GRASSHOPPER PLOW

Clear your fields of destructive 'hoppers with this car-front trap.

by Benjamin Nielsen

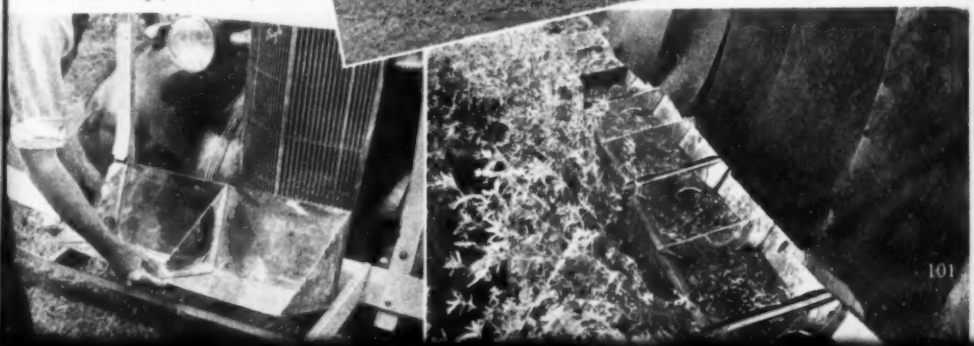
THIS simply made grasshopper catcher utilizes old 5-gallon cans for the oil trough. The inexpensive frame is easily made from lightweight 1"x4" strips which are bolted to uprights which hook onto the car bumpers, as shown in drawing. The tins are cut as indicated and opened up, making two troughs from each. Discarded ferrotyping plates were used as a baffleboard for the original catcher. However, any tin sheets or wallboard could be used.

In operation the outfit is hooked over the bumper and the troughs are provided with a small quantity of water and waste oil. The oil, of course, floats on top. Then as the outfit is driven back and forth across the infected field, grasshoppers aroused by the approaching car, fly up, and hitting the baffleboard, are flung into the oil which kills them in short order.



Left: Framework is simply made from one-by-fours. *Below:* Hanging completed frame on bumper.

Below: Oil tins are sliced catercornered and placed in the carrier, and partially filled with oil and water. 'Hoppers strike baffle and fall into trough, where they die.



LILLIPUPPETS

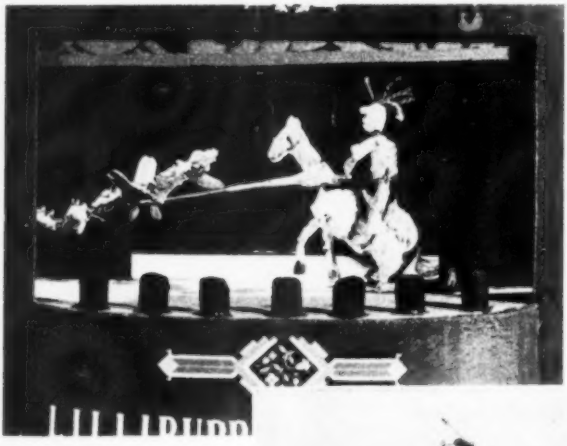
Produce your own stage shows with easily-made midget marionettes.

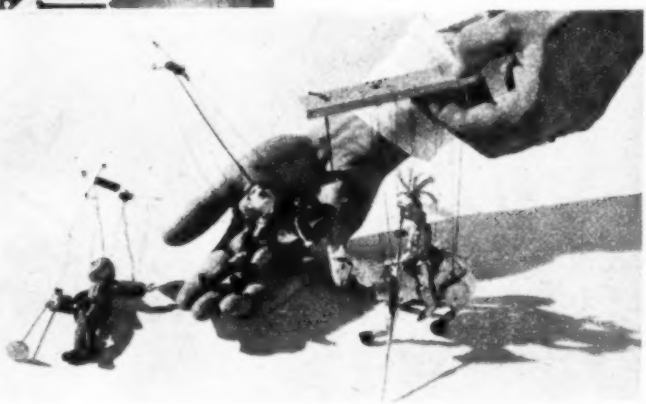
by Leslie P. Guest

MARIONETTES are the most fascinating form of puppets, as they can do practically everything possible for humans and animals except speech. They can enact plays, do stunts and tricks, and there is no end to their possibilities. Marionettes are not necessarily difficult to operate, but to make them at all well is a tedious and often expensive project.

Professional marionettes are usually all-wood, hand-carved; or modelled from plastic wood, and run from 24 inches to 48 inches in height. Each marionette consists of approximately sixteen separate parts, each part carefully shaped and skilfully fitted to its fellow part. The construction of a single figure may take many weeks, or even months, and material alone may run into several dollars. The stringing of an average marionette will use more than a dollar's worth of fish-line alone.

Amateur marionettes may follow the same general plan, running from 16" to 18" in height. Many of them are fully up to professional standards, and often the makers would not part with them for $100 a figure. Others concentrate on making good heads, hands and feet,





Top: The author enacts St. George and the Dragon behind the tiny footlights of the Lilliputpet Theatre, plans for which will be included in a future installment of this article. Above: St. George delivers kayo to nasty dragon. Puppets go through their act with remarkably lifelike movements.

Once you have mastered the easy technique of making Lilliputpets you can indulge your fancy and create characters at will. At right you see the knight St. George on his spirited steed, Franklin D. Roosevelt with microphone, and Adolf Hitler where the United Nations hope soon to have him—in the palm of their hand.

LILLIPUPPET THEATER

The three principal stars in today's drama of world-shaking events. Round, black object in Adolph's left hand is a bomb.

the bodies and limbs, supposedly covered with clothes, being mere bundles of sticks.

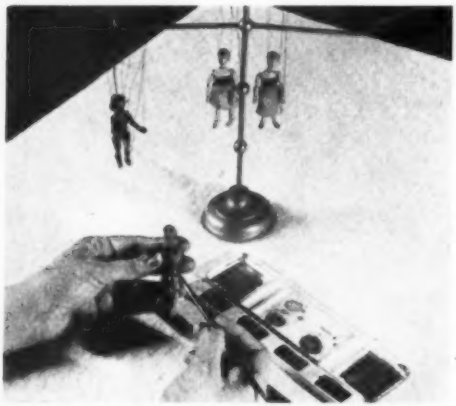
School project and class-room marionettes are apt to be of the rag-doll variety, because the expense is nominal and construction time is comparatively short. Unfortunately the rag-doll marionette is essentially "floppy," and no matter how artfully contrived, still has a marked resemblance to a rag-doll.

Lillipuppets are not proposed to supplant the conventional types of marionettes just mentioned, but form an interesting introduction to the subject, and are fun for both children and adults. They are easy to make, cost very little, and can do nearly everything possible with larger marionettes. The players for an entire production may be made in a week's spare time, and they will last indefinitely. All the long work of fitting joints has been eliminated, and the most inexperienced beginner will enjoy making and working these fascinating little actors.

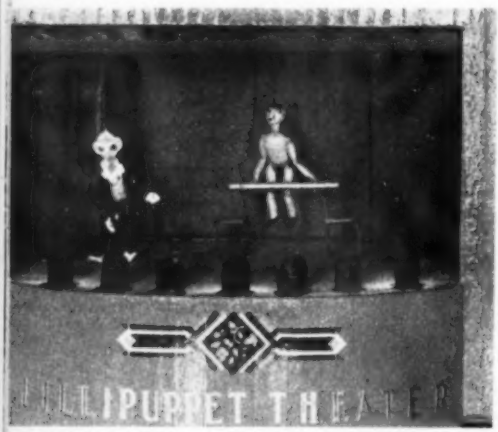
Lillipuppets are made of thin, soft wire

Right: A short length of mailing tube makes an excellent container for the Lillipuppets.

Applying plastic wood over wire "skeleton" to form body.



Finished puppets are painted and dressed in keeping with whatever character they are intended to represent.



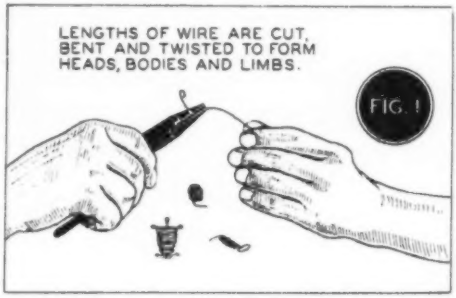
Clown and acrobat give an inspired performance—inspired by the threads leading up to the hands of the operator. It takes little practice to put Lillipuppets through their paces, due to the originally designed, simplified controls.

formed and twisted into shape (Fig. 1). Each part is made separately and then joined by loops, as in Fig. 2, giving the figure extreme flexibility. The wire form is then covered with plastic wood, which is pinched and patted into shape according to the character desired. Then the figure is painted. Often clothes may be painted right on the figure, or simple costumes made from scraps or bits of ribbon. An ingenious type of controller is built right with the figure, and only a few threads make full and easy manipulation possible. This type of controller practically eliminates the bother of tangled threads, a detail which must be carefully watched with conventional marionettes.

All the tools and materials needed for the construction of Lillipuppets are one or two pairs of pliers (preferably sharp-nosed type); pen knife; sandpaper; paints; cotton thread; a couple of 5c coils of iron wire from the hardware store; and a tube or can of plastic wood.

In making the first few Lillipuppets follow the directions and dimensions given here as closely as possible. After the various operations become familiar, there will be room for plenty of variation and individual initiative. Suggestions for alternate methods and "stunt" Lillipuppets will be found later in the text.

Make the body first, as it is the most complicated part, and the other members may be joined to it as they are completed. The body includes five loops, one for the head, two for the arms, and two for the legs. The body should be made the correct size, and the positions of the loops must be accurate, or the figure may turn out lop-sided. Start with a piece of wire about 18" long. Make a small loop at about the center, and with the pliers give it a couple of twists. This will be the head, or neck loop. Make a loop a short distance on each side of the neck loop as shown in the sketches, and these will be at the shoulders. Don't make the loops too small, or the finished joints [*Continued on page* 140]

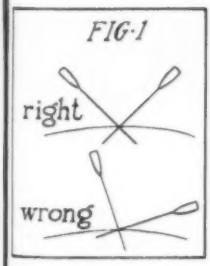


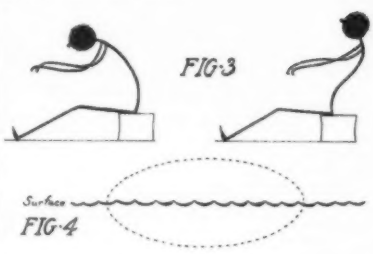
Streamline Your Stroke

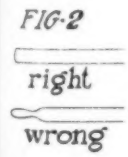
How to get health benefit and pleasure from rowing—using the right muscles!

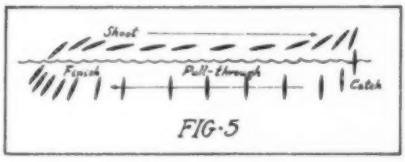
As a glamour actress Ann Sheridan is tops, but as a rower she furnishes a good example of how *not* to do it. Her grip on the oars is bad, blades are inclined at wrong angle, and body position is uncomfortable.

by J. Horton









MOST of us "pick up" rowing, and with it a whole boatload of errors. Rowing in the right way is probably as good an exercise as there is, and can be an enjoyable accomplishment. Rowing in the wrong way—which is the usual way—cramps the lungs, strains the stomach, pulls the back and shoulders out of shape, and can be downright drudgery. Handling a small rowboat is really a matter of applied mechanics, but there are thousands of self-taught rowers dragging and pulling on the wrong set of gears, straining and tugging and thumping against the wrong set of pulleys. It's a simple matter to streamline your stroke away from such unneces-

FIG. 6 Inboard power unit at "catch"—back flat, chest up, shoulders square. Beginning of power stroke.

FIG. 7 "Pull-through," at point where the powerful loin muscles are nearing the contraction limit.

FIG. 8 Arms "break" and take up pull-through in a strong, steady motion that maintains boat's headway.

FIG. 9 The finish, which gives your boat its momentum and lifts the oar blades smartly out of water.

sary stress and strain; to reorganize your muscular effort into a sweet-running inboard power unit.

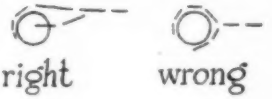
Unless your boat is properly rigged, however, much of your power is going to be dissipated. Many a rowboat seat is too high, so that one feels that he is riding *on* the boat rather than *in* it. Lowering the center of gravity by dropping the seat a couple of inches will greatly improve such a craft's behavior, particularly in rough water. At any rate, the seat should be so low that when the rower sits with feet pressing against the stretcher or footrest, knees slightly bent, his thighs are horizontal or nearly so.

The ideally placed rowlocks allow you to begin the pull and finish it with the oar blade at about the same distance from the boat. (Fig. 1). The oars that come equipped with leather stops are generally too short in the handle, and would be improved by simply moving the stop a few inches down toward the blade, so that at the middle of the pull and at the middle of the recovery the handle-ends overlap by a handbreadth. Oars should balance easily, their weight almost evenly divided between the outside and the inside of the boat. Unless the oars are heavy, the handles should not be smaller than the shaft. (Fig. 2). Contrary to general impression, there is no advantage in heavy oars; the lightness and toughness of spruce oars are not sufficiently appreciated. The part that the hand is to grasp should be left in the natural wood, unvarnished. Curved, or spoon blades, are incomparably better propellers than straight blades.

The ordinary rowboat has four seats—a bow

FIG. 10 Wrist drop rotates oar shafts and flattens blades in preparation for feathering shoot, or recovery.

FIG·11



Here's the correct grip on the oar handle, which is best left unvarnished and shaft thickness.

seat, a stern seat, and two thwarts or rowing seats. If you have passengers or a cargo place the greater part of this extra weight in the stern, but not so much as to sink the stern into the water until it drags. In such a loaded boat you should row from the thwart nearer the bow. When alone, you will find your craft more alert to the oar if you row from the thwart nearer the stern.

Sit well toward the edge of the thwart, and sit straight, chest up, shoulders square and level, back flat. Keep that body alignment throughout the stroke, swinging from the hips. The most frequent faults with beginners are bending the back at the beginning of the stroke and allowing the spine to give under the pull (Fig. 3), with the same waste of power as would result if flexible rubber oar-shafts were used. These faults are sometimes due to weak abdominal muscles, and if persisted in may do real harm. The remedy is to strengthen those muscles before taking to oars.

In the regular crew stroke used in college and school shells, where the oarsmen have sliding seats, the legs take over part of the propulsion. In your rowboat you may disregard your legs. The main pull must come from the big muscles of the lower back, and you must consider the rest of your upper body as a set of straps and levers whose principal job is to transfer the pull of those powerful loin muscles to the water.

Take a look at Fig. 4. The dotted line shows the elliptical path followed by an oar blade under untutored handling—beginning shallow, going deep at the middle of the stroke ("digging," the professionals call it), and then coming slowly to the surface again. "Skying" is the term applied to the habit of lifting the oars too high on the recovery. Sometimes it results in the beginning of the stroke being rowed in the air—reminding one of the terrified man who leaped out of the top window and started his legs running before he reached the ground.

Now examine Fig. 5. This represents a cross-section of an oar blade in a streamlined stroke, adaptable to all types of rowers and rowboats. For convenience it is broken down into four parts: the catch, the pull-through, the finish, and the shoot or recovery.

In preparation for the catch, let the oar blades rest flat on the water and hold the handles with any grip that is easiest for you. We'll improve that grip later, as soon as your other muscles have caught the rhythm of the new stroke.

Now, without changing your grasp, rotate the oar-shafts in the oarlocks until the blades stand perpendicular to the water. Bend forward from the hips and carry the oars back (Fig. 6). You will probably find your greatest difficulty at full reach, for it goes quite against the grain to reach with arms and body, and yet give the shoulders no part. The answer is: do not make the common mistake of reaching for too long a stroke. Forty-five degrees on each side of the [*Continued on page* 166]

Making Plastic Models

Cold water plastic adhesive makes it possible for model builders to produce stronger, lighter models —moulded into any desired shape.

by
Paul Schmitt

This fast model racing car has a body built up of laminated layers of muslin, bound together with plastic adhesive.

Applying the first strip of muslin and plastic to the wood form.

Second layer is laid lengthwise along the hull, well brushed out.

NEXT time you build a model racing car, boat, or for that matter, airplane, build it with a one-piece, strong, light body or hull, cleverly fashioned with the aid of waterproof liquid "plastic"! This method has numerous advantages over conventional wood or metal construction, though it is not intended to replace either of those mediums, but merely to open up a wider field of experimental designing and styling for the enterprising model hobbyist.

For one thing, the use of moulded plastic adhesive bodies permits the modeler a great range of shape possibilities, including compound curves, which are easily attained. Crackups, long a bugaboo of action models, are less of a menace with these moulded bodies, because of their tremendous resilient strength, akin in quality to that of a ping pong ball, though not so brittle.

Plastic models are easily made, and the wooden mould or form over which they are fabricated can be used indefinitely, making it possible to turn them out on virtually a mass production basis, if desired.

First we'll undertake the building of an average model sailboat by this method, then a racing car. All details pertaining to the proc-

Above: Cutting hull loose from form after plastic has hardened.

Left: Center strip is trimmed off at bow with sharp scissors.

ess itself will be described, but no actual design or plans will be given, this being left to the individual modeler, who, it is assumed, will either work out a design of his own or apply the process to some model he was about to construct by conventional means.

Model Boat

The hull is built over a mould, as previously mentioned. This mould may, if you so desire, be made of wood; or it may be a combination of wood and clay. If wood is used, it must be well waxed to prevent adhesion. The composite mould should also be waxed.

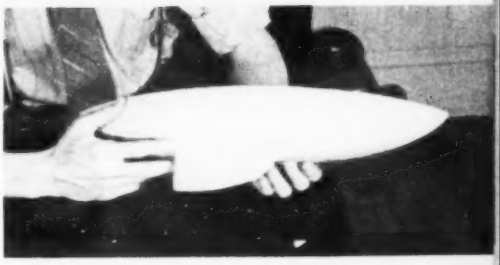
The materials required are strips of cloth (muslin) of convenient width (½" to 1"), and about a pound of cold-setting plastic resin glue. A fairly small stiff brush of the type used to spread glue is also necessary.

The hull is built up of plies—the number of which may range from three to ten, depending on the required strength. Three plies of ordinary cotton sheeting will be about 1/27" thick, while ten plies will be about ⅛" thick.

The first ply should be put on thwartships because the strips are shorter and easier to handle. The strips should be glued to the deck on either side of the mould. This prevents the hull from slipping off the mould during the process of construction. Glue, prepared according to directions on the can, is applied on top of the strips as they are brushed into place. (Take special care with this ply—wrinkles and bulges in the first ply are sure to show in the final result.)

Let the first ply dry well before you start on the second, which is put on fore and aft. This, and all succeeding plies are laid in glue; that is, glue is put under the strip as it is applied and the strip is brushed down into it.

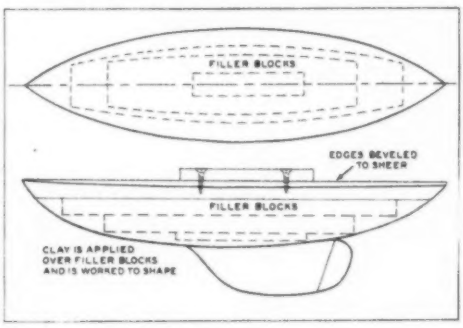
The next two plies should be put on

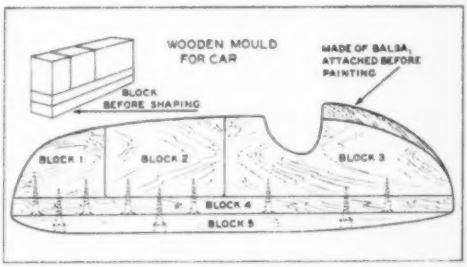


Outer strips laid fore and aft cut hull friction through water.

The moulded hull slips easily off the waxed form.

Completed hull is similar in structure to the moulded plywood dinghies that have been on the market for the past year or so. Thickness with five plies is about 1/16-inch.





Drawings above show form construction for boat *(left)* and model car *(right)*. Whether clay or solid wood the forms should be well waxed before applying laminations and adhesive, in order to prevent sticking.

Car body is made on a mould consisting of five separate blocks shaped as in sketch and held together with screws.

With hood block held in a vise the first strip is brushed on.

diagonally and at right angles to each other. If more than six plies are desired, put the necessary number in diagonally at this point.

The next to the last ply is put on thwartships and the last fore and aft. The first ply is the only one that is glued to the deck. All succeeding plies should stop at the sheer.

Allow the hull to set for a few days before sanding it smooth. After sanding, brush on another coat of glue as a base for paint. Let the hull cure in a warm place for at least a week, before removing it from the mould. To remove the hull, simply cut the first ply along the gunwale; the hull should slip off easily.

As plastic resin glues are completely waterproof and rotproof, your hull is practically indestructible. It won't rust, nor will it warp. It must, however, be kept away from intense heat.

Decks may be made of plastic, but I believe that the conventional beam and plank wooden deck is easier to make and almost as serviceable, since most decks on models don't have to bear much, if any weight.

The advent of plastic resin glues has brought about changes in the field of model boats. Now those of us who are not so proficient with the chisel and gouge can compete on slightly better than even terms with the more skilled in any class, be it sailing or gas powered.

Model Car

In the past, in order to build a good race car, one needed to be a combination tinsmith, sheet metal worker, and jeweler. Those days are past. Now, thanks to cold setting plastic resin glues, it is possible for anyone equipped with the most elementary tools, to make a car body that is good looking, light and strong, with a minimum of time and money. Less than half a pound of glue is used. The only other requirement is a small quantity of cotton sheeting or similar cloth.

This body is built over a mould (in the same manner as the boat hull) consisting of five blocks of soft, easily worked wood, such as balsa or white pine. They are screwed together, as shown in the sketch, and then worked to shape.

After shaping, block No. 5 and block No. 2 are removed. [*Continued on page* 168]

Above, left: Lamination progresses, with alternate layers running in opposite directions for maximum strength.

Left: When "shell" has hardened it is removed from form and will maintain its shape thereafter. It will take much punishment.

HOME AIDS

New Life For Old Phonograph Records

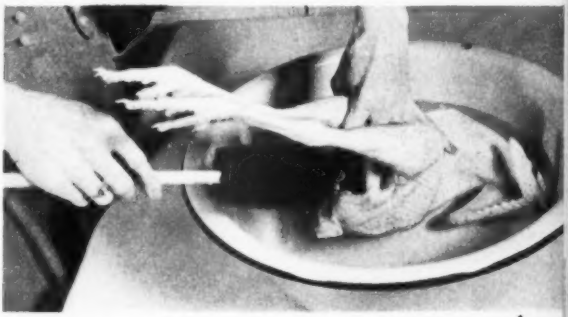
AFTER continued use, tiny particles of record material collect in the grooves. If the record is immersed briefly in warm water and soap suds, then rinsed in clean water, tone will improve.

Old Typewriter Ribbons Yield Writing Ink

OLD typewriter ribbons will yield a fairly good ink if placed in a jar of hot water and left a few days.—*W. S.*

To Pick Up Broken Glass

THE problem of broken glass and how to clean it up loses some of its terrors for the finger tips if a slightly moistened paper cleaning tissue is used. Even the tiny fragments will adhere to the damp tissue.—*B. N.*



For Cleaning Chickens

A LONG handled bottle brush is a handy item to keep around the kitchen for thoroughly washing the inside of chickens or other fowl before cooking. It should, of course, be thoroughly washed after using it.—*B. N.*

Funnel Cools The Cake

WHEN baking angel food and similar cake, the cooling time can be considerably shortened if the pan is supported on an inverted funnel as shown while it is cooling.—*W. S.*

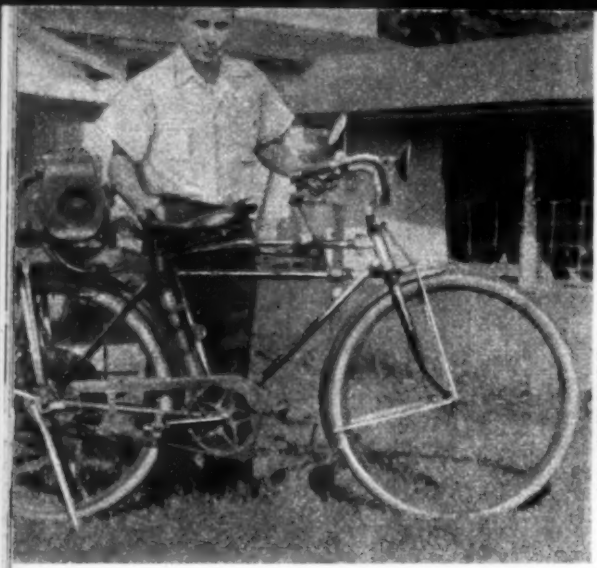
FINGERS

FINGERS plus a pair of artificial eyes and some odds and ends furnish the material for an unlimited number of grotesque and laughable "handles." Remove the eyes from an old doll or buy a pair for 50 cents or so, and use them as the principal "prop." By trying various accessories and finger manipulations you will obtain some startling results. For instance, the lorgnette of the old lady at top right is nothing but a pair of ordinary nail scissors.

S And FACES

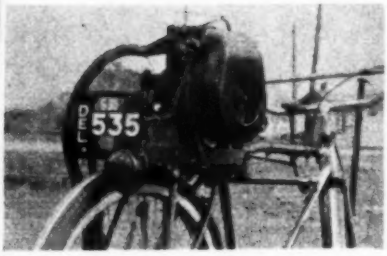
Some amusing tricks that anyone can learn in a few minutes' time.

THE YOUNG LADY with all the oomph (!) shows you how to take a cigarette the hard way, though it really isn't hard once you get the hang of it. Begin by tilting back the head and puckering lips to support the fag between upper lip and nose. Next, lower chin slightly, allowing coffin nail to drop to extended lower lip. Move lower lip to side (preferably *without* dislocating jaw) and snap butt into smoking position, using tongue and lips to guide it; no other holds allowed. If you can't perform the whole trick in a flash after a little practice just forget it and smoke a pipe instead.



MOTORIZE

Drawings by
Douglas Rolfe



Above: The original "conversion". Some states require a license for motor bike operation. Inquire of your own Motor Vehicle Bureau.

MOTOR bike enthusiasts cramped by priority restrictions will like this anyway, even if their natural inclinations may turn toward something more surging in the way of power, but we think that many of our readers who, up till Pearl Harbor at any rate, ordinarily associated motorbikes with speed cops and unearthly noises will find the ideas and suggestions contained in this article well worth their while as one means of solving the rapidly developing problem of how to get around without buying a horse.

The ideas suggested in this article were prompted by the excellent conversion job done by John Pitlick, Jr., of Harrington, Delaware, drawings of which appear in Fig. 1 and other sketches. Pitlick's conversion is the acme of simplicity and common sense and is, as one might guess, the work of a clever mechanic.

Quite apart from expense it is not feasible to introduce too much power into the average bike frame. Pitlick employs a standard ½ h.p. washing machine motor, which is somewhat

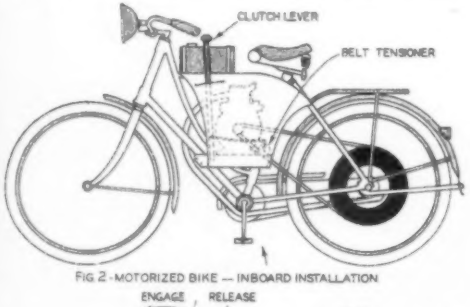


FIG 2 - MOTORIZED BIKE — INBOARD INSTALLATION

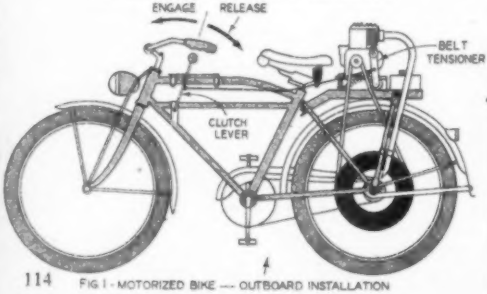


FIG 1 - MOTORIZED BIKE — OUTBOARD INSTALLATION

Left: The two types of installation described in the article —motor over rear wheel and slung inside bike's frame. *Below:* Any bike with a strong frame can be converted. With ½ h.p. motor you'll get up to 90 miles on a gallon.

YOUR BIKE!

Tired of pedalling? Then install a light motor and ride in luxury.

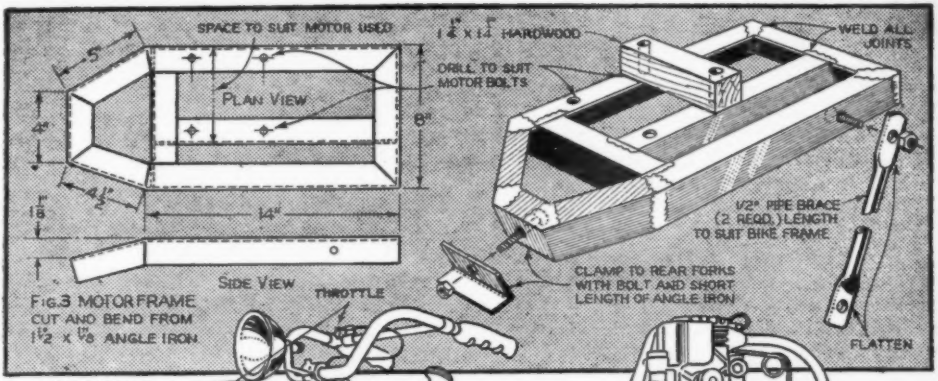


FIG.3 MOTOR FRAME CUT AND BEND FROM 1½" x ⅛" ANGLE IRON

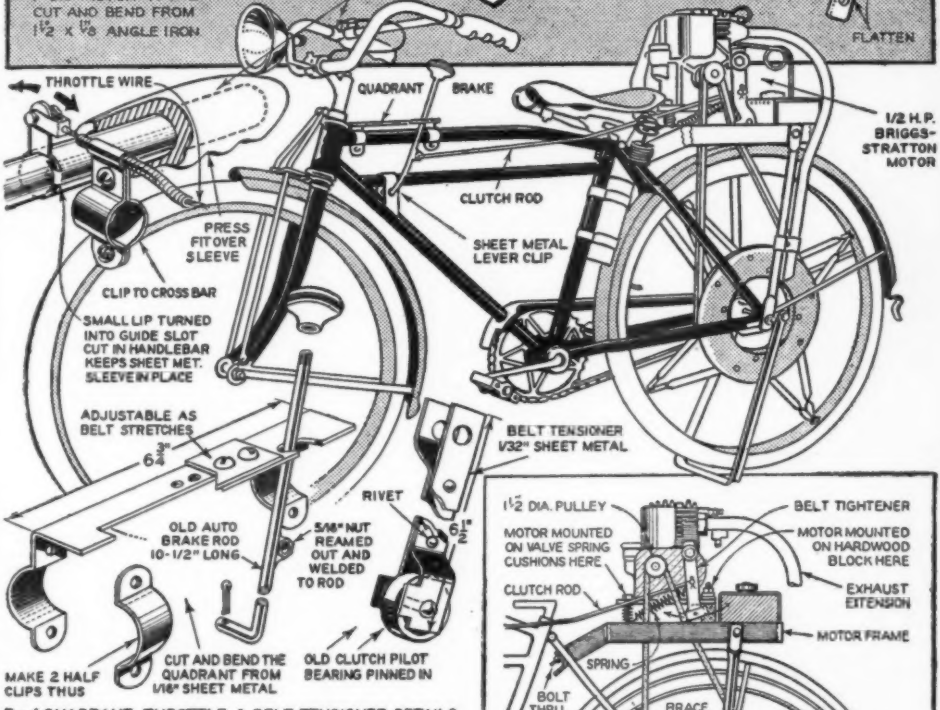

THROTTLE WIRE
QUADRANT
BRAKE
1/2 H.P. BRIGGS-STRATTON MOTOR
CLUTCH ROD
SHEET METAL LEVER CLIP
PRESS FIT OVER SLEEVE
CLIP TO CROSS BAR
SMALL LIP TURNED INTO GUIDE SLOT CUT IN HANDLEBAR KEEPS SHEET MET. SLEEVE IN PLACE
ADJUSTABLE AS BELT STRETCHES
6¾"
BELT TENSIONER 1/32" SHEET METAL
RIVET
6½"
OLD AUTO BRAKE ROD 10-1/2" LONG
5/16" NUT REAMED OUT AND WELDED TO ROD
MAKE 2 HALF CLIPS THUS
CUT AND BEND THE QUADRANT FROM 1/16" SHEET METAL
OLD CLUTCH PILOT BEARING PINNED IN

FIG.4 QUADRANT, THROTTLE & BELT TENSIONER DETAILS

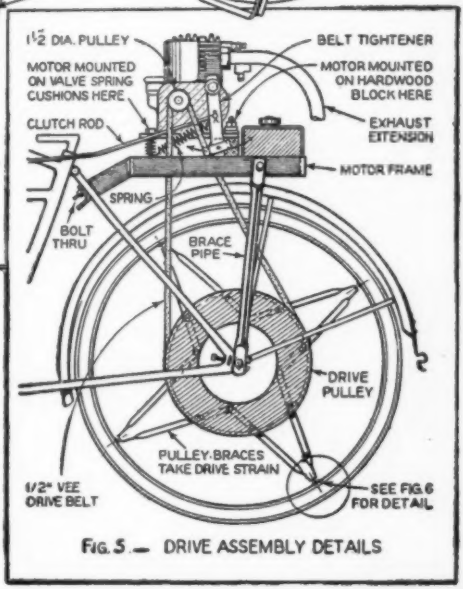


FIG. 5 — DRIVE ASSEMBLY DETAILS

on the thin side but, geared as he has it, sufficient for everyday use (20 m.p.h. on the level) with pedalling a last resort on steep hills as well as a means of starting the motor.

Motorized bikes of this type are more than toys today. Think of it! You want to save the tires of the family car yet still find that mile or so of travel to the local post office or railroad station a real chore. Pedalling a bike around is all right of course, but there is something in most Americans that yearns for

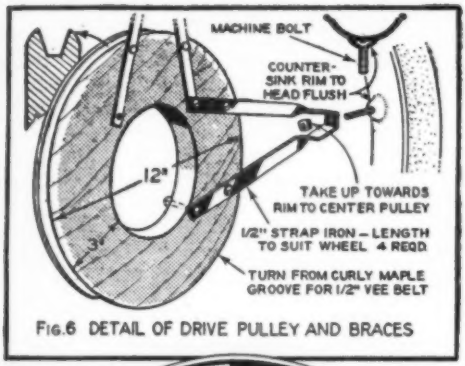

MACHINE BOLT
COUNTER-SINK RIM TO HEAD FLUSH
12"
3"
TAKE UP TOWARDS RIM TO CENTER PULLEY
1/2" STRAP IRON – LENGTH TO SUIT WHEEL 4 REQD
TURN FROM CURLY MAPLE GROOVE FOR 1/2" VEE BELT

FIG.6 DETAIL OF DRIVE PULLEY AND BRACES

the feel of a motor, no matter how small, when it comes to even short haul transportation.

Two types of conversion are covered in the drawings, neither of them, however, sufficiently powered for the sidecarette which can be easily and inexpensively built to make your bike a real utility vehicle. For this sidecar at least one horsepower is recommended. This will take care of ordinary travel and only call for some assistance in the way of pedalling on steep hills.

We'll take Pitlick's conversion first. This is an outboard installation as the drawings show. That is to say the motor and entire drive unit is located outside the bike frame and permits the use of almost any type of small motor without any formidable difficulties.

As shown in the drawings, the motor is mounted on a sturdy angle iron frame directly over the rear wheel of the bike. The power is carried by means of a vee belt to a wooden pulley attached to the rear wheel. This pulley is in no way attached to the spokes of the wheel but is really suspended from the rim by four strap iron hangers. Anyone with any experience in small power bike jobs will appreciate this feature of the conversion, as it entirely overcomes the otherwise ruinous

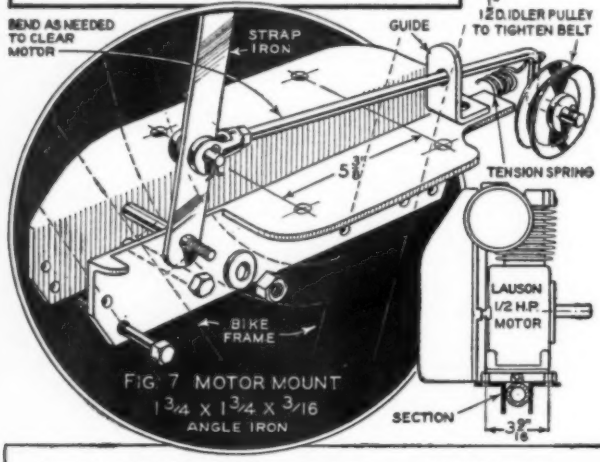


FIG. 7 MOTOR MOUNT
1 3/4 X 1 3/4 X 3/16
ANGLE IRON

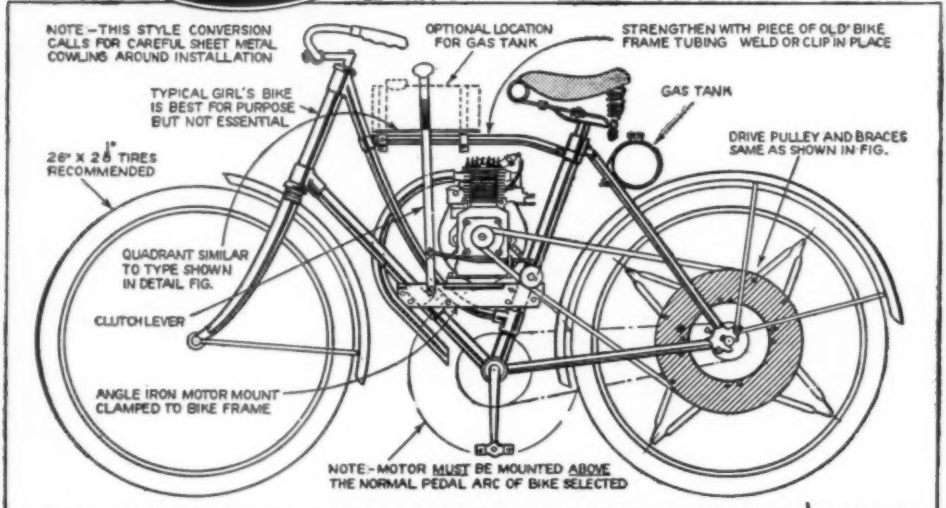

NOTE – THIS STYLE CONVERSION CALLS FOR CAREFUL SHEET METAL COWLING AROUND INSTALLATION
OPTIONAL LOCATION FOR GAS TANK
STRENGTHEN WITH PIECE OF OLD BIKE FRAME TUBING WELD OR CLIP IN PLACE
TYPICAL GIRL'S BIKE IS BEST FOR PURPOSE BUT NOT ESSENTIAL
GAS TANK
DRIVE PULLEY AND BRACES SAME AS SHOWN IN FIG.
26" X 2 1/8" TIRES RECOMMENDED
QUADRANT SIMILAR TO TYPE SHOWN IN DETAIL FIG.
CLUTCH LEVER
ANGLE IRON MOTOR MOUNT CLAMPED TO BIKE FRAME
NOTE – MOTOR MUST BE MOUNTED ABOVE THE NORMAL PEDAL ARC OF BIKE SELECTED

FIG. 8 – SUGGESTED INBOARD INSTALLATION UTILIZING LAUSON TYPE RLC OR SIMILAR ½ H.P. MOTOR

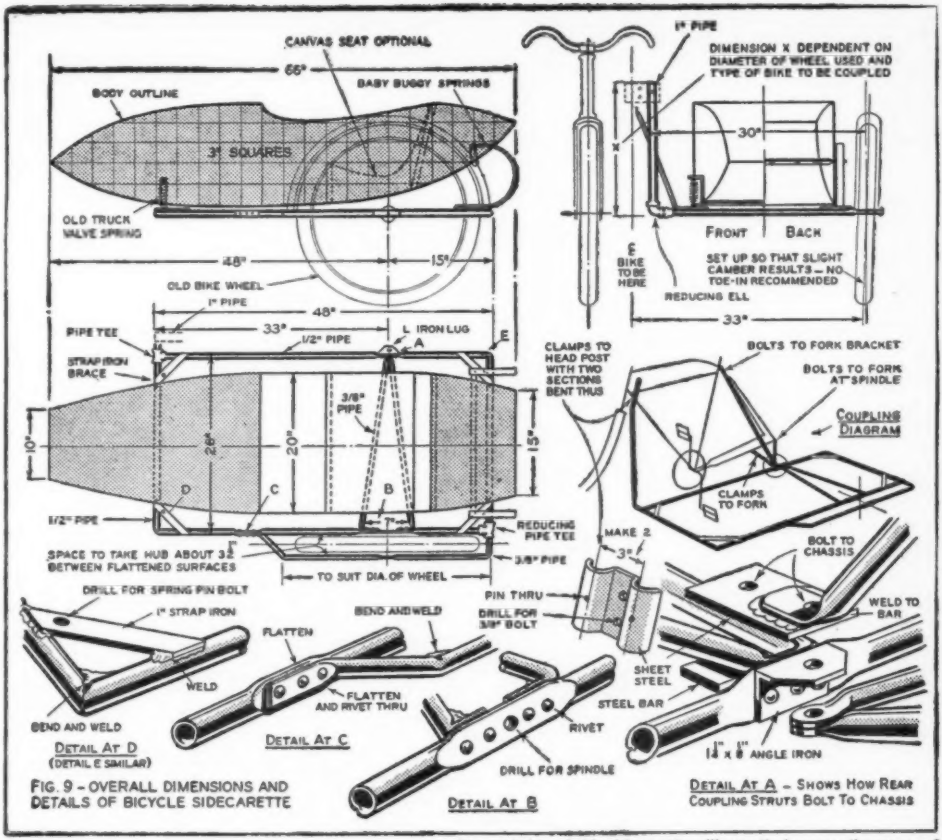


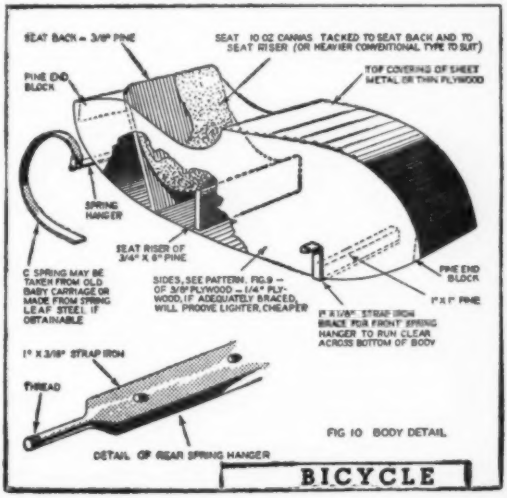
FIG. 9 – OVERALL DIMENSIONS AND DETAILS OF BICYCLE SIDECARETTE

The addition of this sidecarette will greatly increase the scope of a bicycle's usefulness. Can carry a full grown passenger or cargo and may be attached to any bike, either with or without a motor. In the latter case an engine of 1 or 1½ h.p. is recommended.

drive strain which ordinarily results in weakened spokes and buckled wheels. Power is transmitted by a standard half-inch vee belt. Belt tension is provided by an ingenious idler pulley device as shown in the detail drawings, Fig. 4 and Fig. 5. This idler pulley not only serves as a belt tensioner, but affords a smooth operating clutch which enables the rider to make easy starts and stops without killing the engine.

By moving the clutch lever back and forth an absolute neutral position, a partially engaged position and a fully engaged positive drive are at the rider's disposal. In the partially engaged position the tensioner is held against the belt by the pull of a coil spring and affords a smooth running three mile an hour gait which is handy in traffic.

The dimensions given for the motor mount in Fig. 3 [*Continued on page* 174]


SEAT BACK – 3/8" PINE
SEAT 10 OZ CANVAS TACKED TO SEAT BACK AND TO SEAT RISER (OR HEAVIER CONVENTIONAL TYPE TO SUIT)
PINE END BLOCK
TOP COVERING OF SHEET METAL OR THIN PLYWOOD
SPRING HANGER
SEAT RISER OF 3/4" X 6" PINE
PINE END BLOCK
C SPRING MAY BE TAKEN FROM OLD BABY CARRIAGE OR MADE FROM SPRING LEAF STEEL IF OBTAINABLE
SIDES, SEE PATTERN, FIG. 9 – OF 3/8" PLYWOOD – 1/4" PLYWOOD, IF ADEQUATELY BRACED, WILL PROVE LIGHTER, CHEAPER
1" X 1" PINE
1" X 1/8" STRAP IRON BRACE FOR FRONT SPRING HANGER TO RUN CLEAR ACROSS BOTTOM OF BODY
1" X 3/8" STRAP IRON
THREAD
FIG 10 BODY DETAIL
DETAIL OF REAR SPRING HANGER

BICYCLE

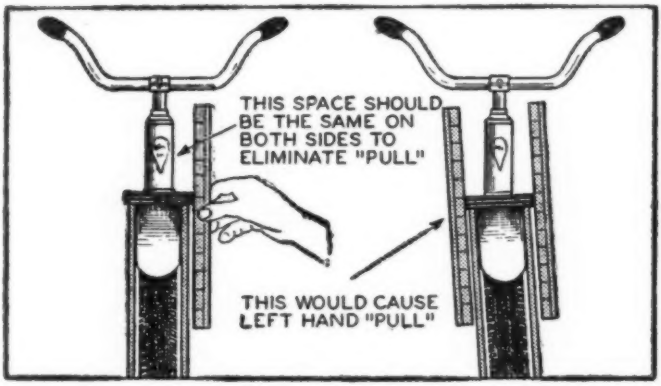
IDEAS FOR

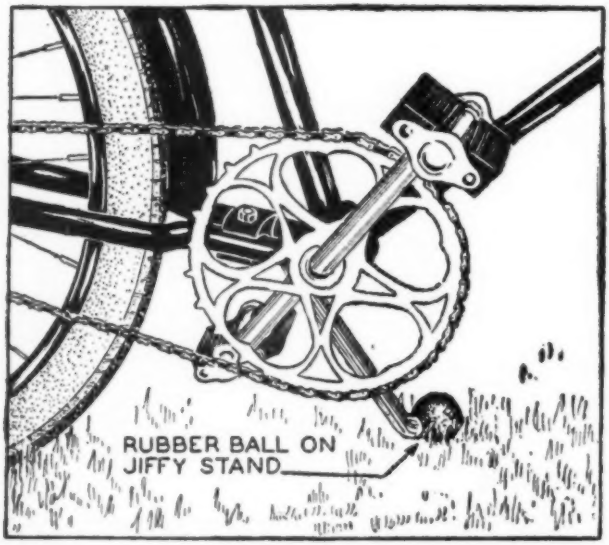
Straps Hold Articles In Basket

BOOKS or small articles can be prevented from bouncing out of the bicycle basket by the use of two straps cut from an old inner tube. Attach the straps to the bottom of the basket with the two dowels, as at left. They can then be stretched over package.

Straightening Bent Forks

IF THE front forks of a bike are bent as shown, bike will pull to one side. By placing a straight ruler along both sides of the fork and measuring between ruler and steering pivot, alignment can be checked. If both measurements are the same, forks are OK.





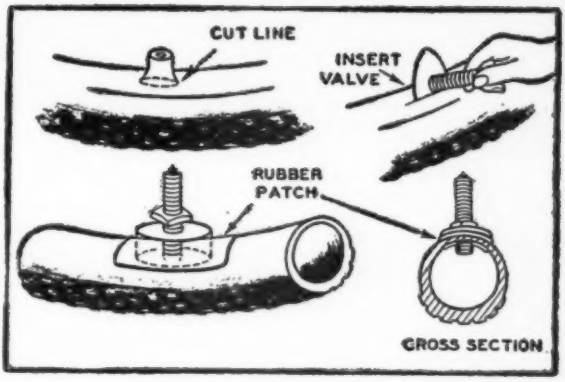
Improving Jiffy Stands

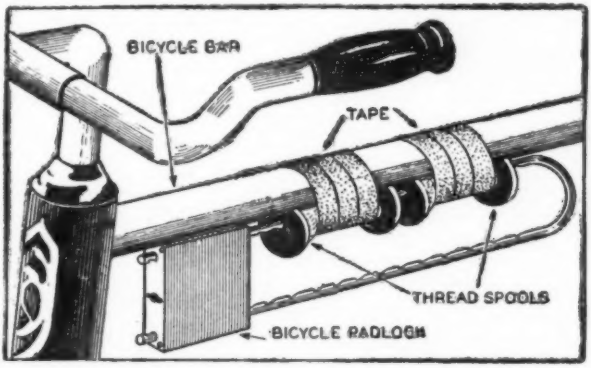
THE ordinary jiffy, or kick stand that is attached to the side of the bike's frame opposite the sprocket does not always give adequate support, particularly when the bike is parked on soft ground or a smooth surface. The cause of the trouble lies in the hardened point of the stand slipping on hard places and sinking into soft ones. A remedy is to drill a small hole in a hard rubber ball and press the ball firmly over the end of the stand. This will assure a good grip on any surface.

BICYCLISTS

Repairing Damaged Valves

CONTRARY to general belief, a high pressure single-tube bicycle tire *can* be repaired, even if the entire valve assembly has torn out, and it is not necessary to throw the tire away and get a new one when this [*Continued on page* 164]



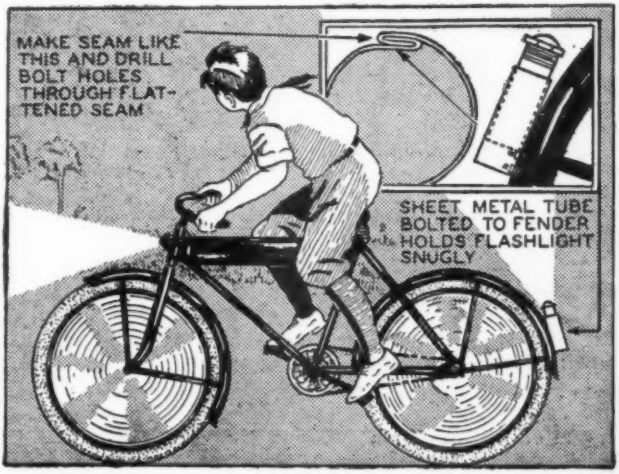


Padlock Holder

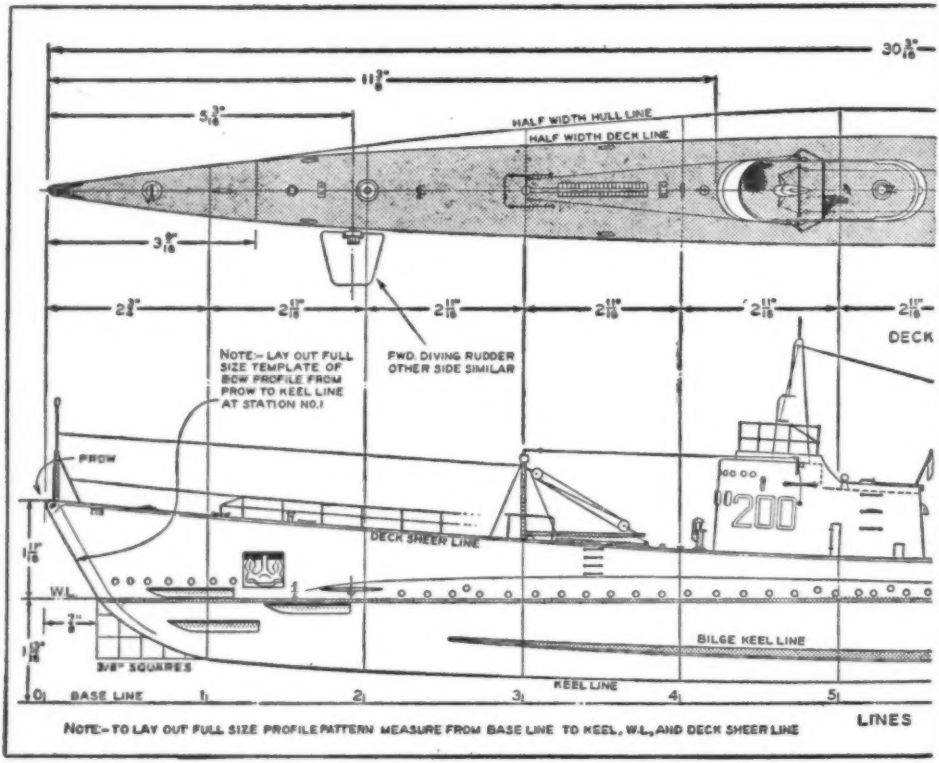
THE long-shanked bicycle padlock is generally a nuisance to carry around, as a suitable spot for it on the average bike is almost impossible to find—no matter where you put it, the darned thing will rattle. Two large spools, shaped on one side to fit the bar, and taped to the latter, will provide a rattle-proof resting place for the lock. Sketch at left gives details.

Reliable Bicycle Lights

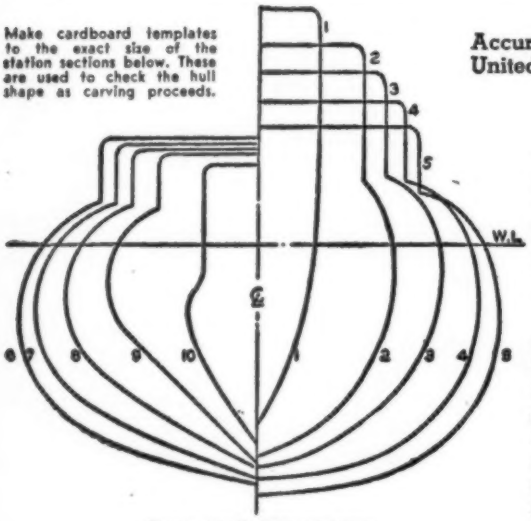
AN ORDINARY flashlight of the type shown mounted as a headlight provides ideal illumination for night biking. If mounted on the steering post, it will not wobble with each small movement of the handlebars. Regular cylindrical flashlights make excellent tail lights when mounted in a snug-fitting sheet metal tube bolted to rear mudguard.


MAKE SEAM LIKE THIS AND DRILL BOLT HOLES THROUGH FLATTENED SEAM
SHEET METAL TUBE BOLTED TO FENDER HOLDS FLASHLIGHT SNUGLY

BUILD A MODEL


HALF WIDTH HULL LINE
HALF WIDTH DECK LINE
NOTE:- LAY OUT FULL SIZE TEMPLATE OF BOW PROFILE FROM PROW TO KEEL LINE AT STATION NO.1
FWD. DIVING RUDDER OTHER SIDE SIMILAR
DECK
PROW
DECK SHEER LINE
W.L.
BILGE KEEL LINE
KEEL LINE
BASE LINE
LINES
NOTE:- TO LAY OUT FULL SIZE PROFILE PATTERN MEASURE FROM BASE LINE TO KEEL, W.L. AND DECK SHEER LINE

Make cardboard templates to the exact size of the station sections below. These are used to check the hull shape as carving proceeds.



FULL SIZE TEMPLATES

Accurate model (minus secret details) of a United States Navy "T" Class Submarine.

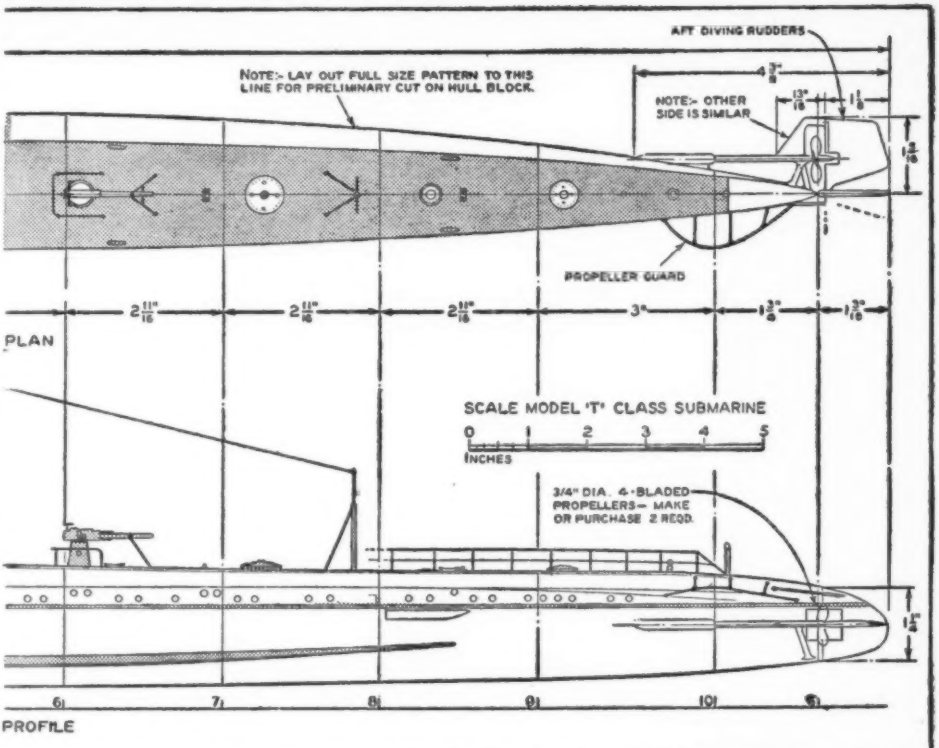
ALL through the day and night our radios are telling us the events of the battle of the Atlantic and of the Pacific. Each day brings more news of the exploits of our submarines. As a result, many model fans all over the country are anxious to build a model of one of these avengers of the sea.

And while little information is available on our new submarines, enough material has been gathered together to enable the builder to make a fairly accurate "T" class model. Naturally, some details have been omitted from our model for obvious reasons, but all in all it is complete enough to satisfy the average model builder.

Nothing, of course, can be said of its

SUBMARINE

by Herbert Lozier


AFT DIVING RUDDERS
NOTE:- LAY OUT FULL SIZE PATTERN TO THIS LINE FOR PRELIMINARY CUT ON HULL BLOCK.
NOTE:- OTHER SIDE IS SIMILAR
PROPELLER GUARD
PLAN
SCALE MODEL 'T' CLASS SUBMARINE
INCHES
3/4" DIA. 4-BLADED PROPELLERS— MAKE OR PURCHASE 2 REQD.
PROFILE

By placing the two halves of the above drawing together you'll obtain side and deck plan of the model with all important dimensions and details indicated.

prototype's endurance, nor of its speed, the number of men it carries, or where "T" class subs are stationed. The general specifications are: length, about 310 feet, beam, 27 feet, surface displacement, approximately 1,475 tons.

Starting The Model

The method of building the hull is simple, though care should naturally be taken while carving. This is because the shape of the hull varies from bulging to straight. Frequent checkings against the plans and templates is urged.

It is suggested that the hull be built out of a single block of clear grained white pine, 3½"x3⅛"x29¼". However, two blocks may be used, and if this is done, arrange the blocks so they join at the water line. Glue the blocks under clamps, using a good waterproof glue.

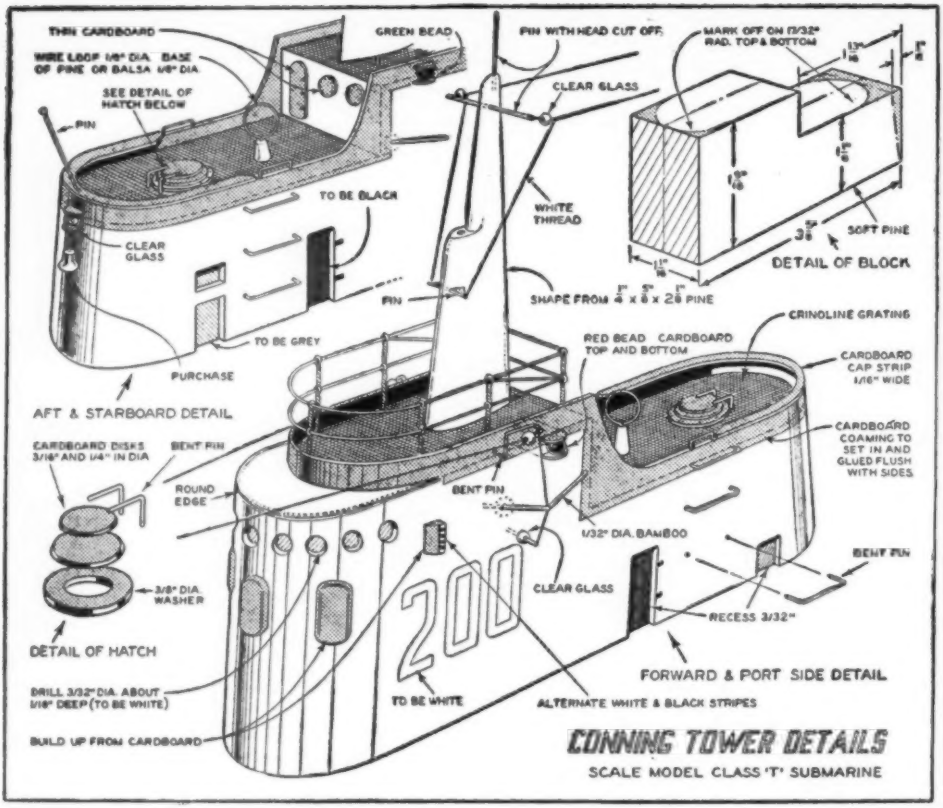
When you are ready to go ahead, mark the center and water line on the block. Then carefully make a full size pattern of the top—at the widest section shown on the plan—and a separate one for the deck and profile. Trace around the top pattern, and cut the wood down, leaving about ⅛" all around.

Then repeat the process with the profile. Be sure that the traced outline matches on both sides. Trim down, allowing ⅛" all around again.

Check the roughed-out block with a square. Redraw the center and waterlines and add the template lines.

Fasten a round length of wood (a broomstick will do) to the hull. Make sure that the screw holes you fasten it through will later on be covered up by a hatch or the conning tower. This dowel allows you to place the block in the vise and tilt it to any angle you want.

Now begin the actual carving. Start at the



center, using No. 5 & 6 templates. Work toward the stern and then the bow, on each side. Always use more than one template. Do not cut down to the exact shape of any one template or your hull with be bumpy.

When you have finished the aft portion, using two or more templates, cut down carefully forward until you have approximated the general shape of the hull.

Do your final cutting with a plane, set fine, and various grades of sandpaper. Remember to constantly check the hull against the plans and templates during this final finishing. Be extremely careful, for the hull is a tricky shape. Notice that the edges of the deck are rounded, and there is no crowd to it. The deck pattern should be used as a final check to the hull shape.

The recesses for the anchors, bow line ports, and torpedo tubes should be put in the hull next.

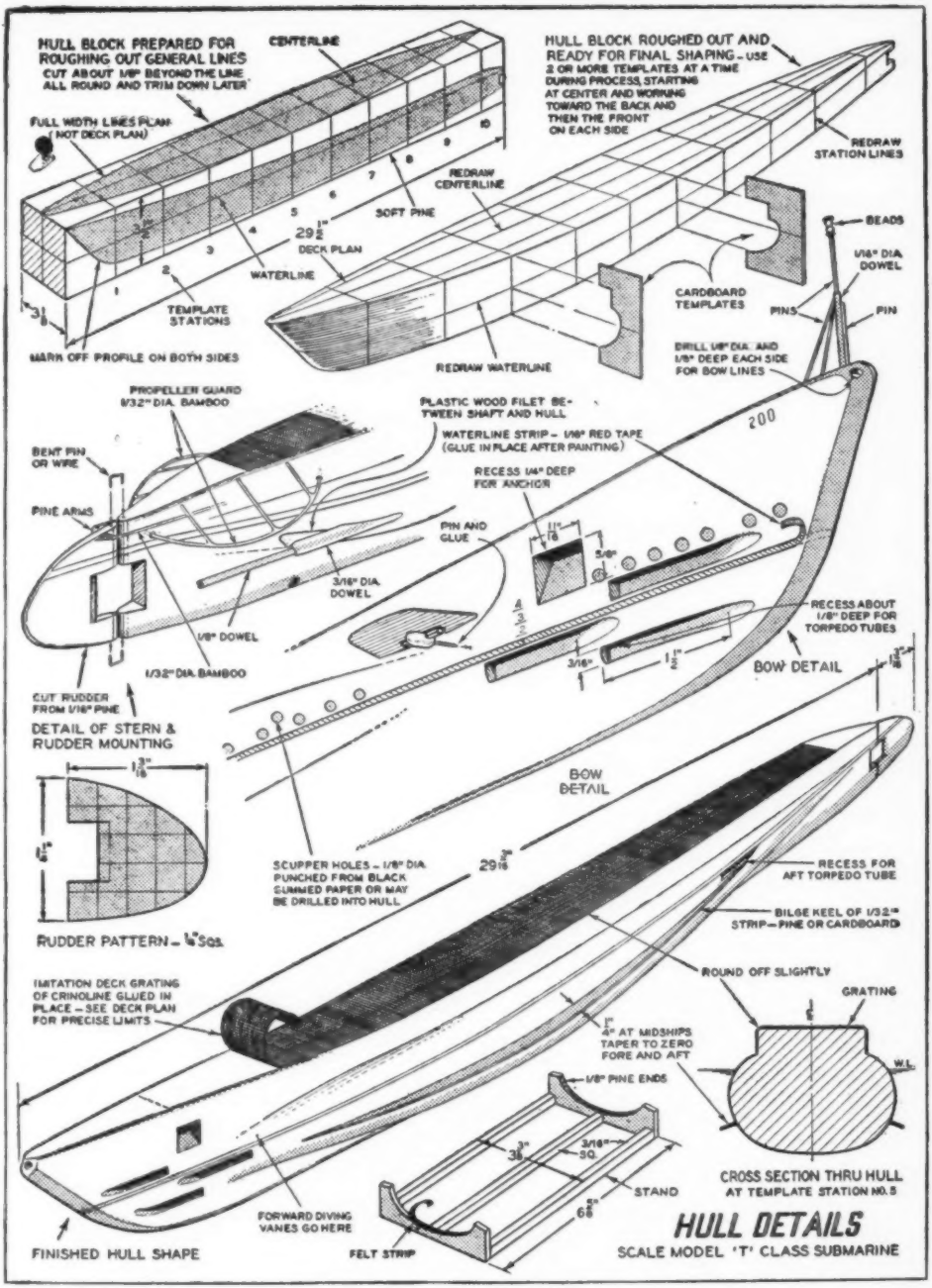
Give the hull a final sanding and checking, then glue the bilge keels in place. Make them from pieces of pine, $\frac{1}{16}$"x$\frac{1}{2}$"x$\frac{3}{4}$". See the drawings.

Finally add the deck grating, a length of crinoline (wide woven fabric looking like screen). Notice the grating starts about 3¾" from the bow and ends about 3" from the extreme end of the rudder. Glue it to the deck.

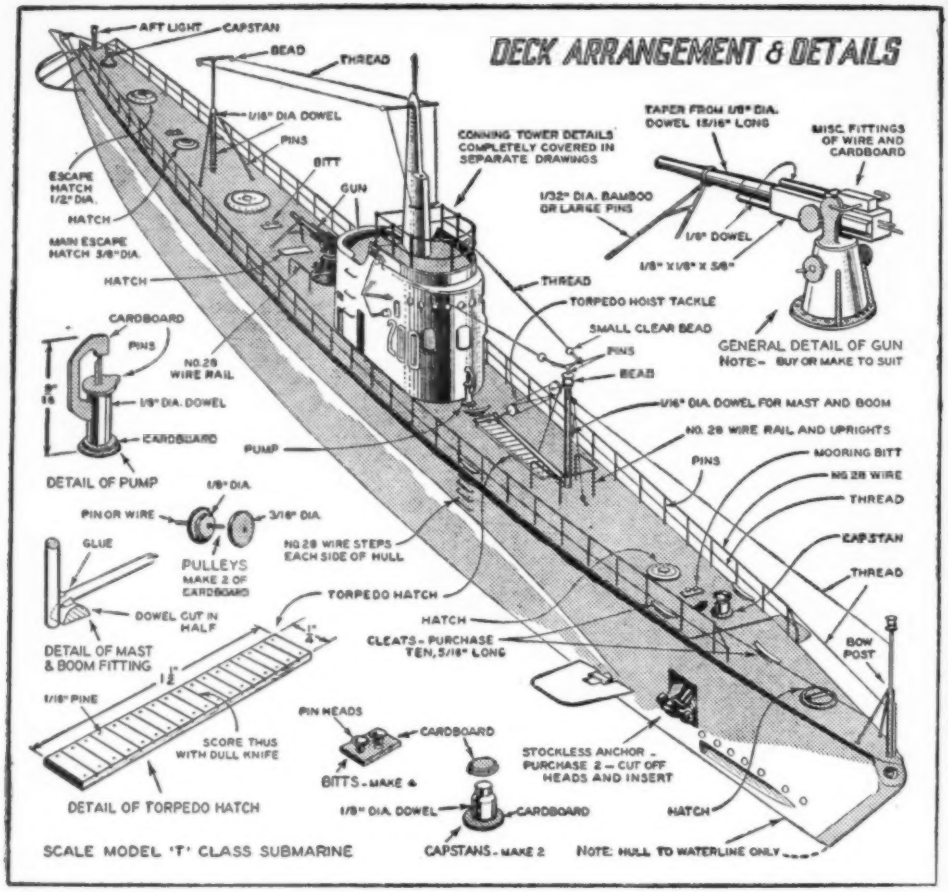
The rudder is made from a $\frac{1}{16}$"x1$\frac{1}{2}$"x1$\frac{1}{2}$" piece of pine, as shown on the plan. Make a stand for the model next, using templates No. 4 & 6 for the cradle. It will make work easier.

The forward diving rudders should be made from two pieces of wood $\frac{1}{16}$" thick 1⅛"x⅞". Give them a streamline shape and add a knuckle or shaft.

These are built up from dowel sticks $\frac{3}{16}$" in diameter, glued together in the shape of a "T." The whole construction will be found on the plan. Glue the knuckle to the vane, one right and one left. They may be fastened to the hull with glue and a pin, whose head is clipped off and inserted into the dowel and


HULL BLOCK PREPARED FOR ROUGHING OUT GENERAL LINES
CUT ABOUT 1/8" BEYOND THE LINE ALL ROUND AND TRIM DOWN LATER
CENTERLINE
FULL WIDTH LINES PLAN (NOT DECK PLAN)
HULL BLOCK ROUGHED OUT AND READY FOR FINAL SHAPING - USE 2 OR MORE TEMPLATES AT A TIME DURING PROCESS, STARTING AT CENTER AND WORKING TOWARD THE BACK AND THEN THE FRONT ON EACH SIDE
REDRAW STATION LINES
REDRAW CENTERLINE
SOFT PINE
DECK PLAN
WATERLINE
TEMPLATE STATIONS
MARK OFF PROFILE ON BOTH SIDES
REDRAW WATERLINE
CARDBOARD TEMPLATES
BEADS
1/16" DIA. DOWEL
PINS
PIN
DRILL 1/16" DIA. AND 1/8" DEEP EACH SIDE FOR BOW LINES
PROPELLER GUARD 1/32" DIA. BAMBOO
PLASTIC WOOD FILET BETWEEN SHAFT AND HULL
WATERLINE STRIP - 1/16" RED TAPE (GLUE IN PLACE AFTER PAINTING)
BENT PIN OR WIRE
PINE ARMS
RECESS 1/4" DEEP FOR ANCHOR
PIN AND GLUE
3/16" DIA. DOWEL
1/8" DOWEL
1/32" DIA. BAMBOO
RECESS ABOUT 1/8" DEEP FOR TORPEDO TUBES
BOW DETAIL
CUT RUDDER FROM 1/16" PINE
DETAIL OF STERN & RUDDER MOUNTING
BOW DETAIL
SCUPPER HOLES - 1/8" DIA. PUNCHED FROM BLACK GUMMED PAPER OR MAY BE DRILLED INTO HULL
RECESS FOR AFT TORPEDO TUBE
BILGE KEEL OF 1/32" STRIP - PINE OR CARDBOARD
RUDDER PATTERN - ½" Sqs.
IMITATION DECK GRATING OF CRINOLINE GLUED IN PLACE - SEE DECK PLAN FOR PRECISE LIMITS
ROUND OFF SLIGHTLY
GRATING
W.L.
1/8" AT MIDSHIPS TAPER TO ZERO FORE AND AFT
1/8" PINE ENDS
3/16" SQ.
STAND
CROSS SECTION THRU HULL AT TEMPLATE STATION NO. 5
FORWARD DIVING VANES GO HERE
FELT STRIP
FINISHED HULL SHAPE
HULL DETAILS
SCALE MODEL 'T' CLASS SUBMARINE

Care exercised in creation of the deck and conning tower fittings, as shown in the drawing on opposite page, will lend to your model an extremely realistic appearance when completed. *Above:* **Study carving instructions at top before starting work.**



Location and type of principal deck fittings is shown above. Parts to be purchased can be made instead if desired.

the hull, as a peg. The assembly of the propellers, aft diving rudders or vanes, and propeller guards come next.

It is best to begin with the $\frac{3}{16}$" dowel of the prop shafts, that are glued to the hull. Shape these dowels (two) as shown on the plan, one end being rounded to the hull and the other beveled off to fit the ⅛" dowel.

After the shaping is finished, these dowels are glued and pin-pegged to the hull. When the glue has dried, the space between them and the hull is filled with plastic wood to form a streamline. You will find the exact shape in the drawings. Make sure that the shafts line up.

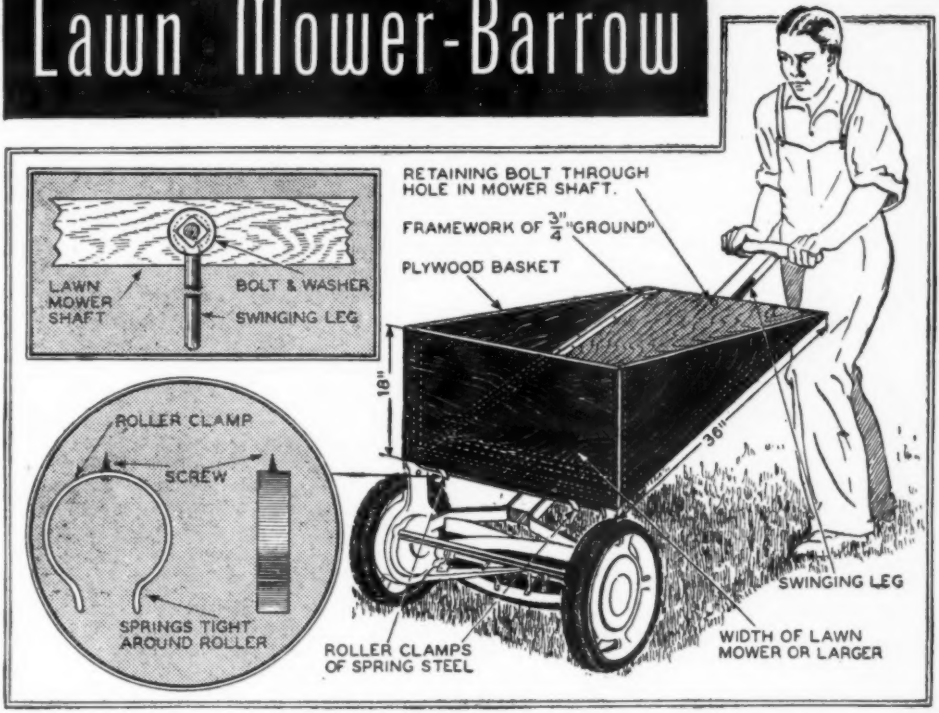
Now to the end of these dowel, the middle or ⅛" dia. shafts are added. They are 1¾" long. Notice they are braced by two struts, as shown on the plan.

These braces are streamlined to shape from a piece of strip 1/6" thick, and are ⅞" and ½" long. The longer going to the bottom.

The propellers may be purchased and the spinner added to conform with the measurements given on the plans. The length of the props and spinner from end to tip of the spinner should not be more than $\frac{9}{16}$", with a ⅛" dia. center. Glue to the ⅛" shafts.

The aft diving vanes are made now. They are cut out of $\frac{1}{16}$" wood, to the size and shape given on the plan. Streamline them and glue together, and to the shafts. It is best to add one side at a time so that you will have no trouble slipping the [*Continued on page* 154]

Lawn Mower-Barrow



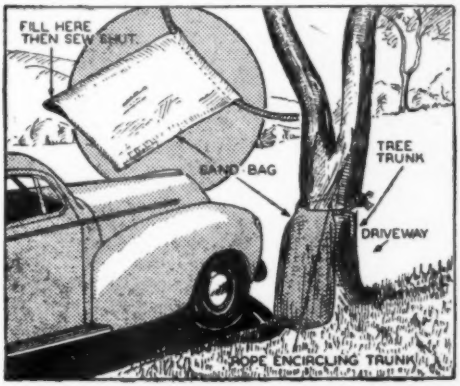
Lawn Mower-Barrow

WHEN a lawn mower is upended so the roller is off the ground it can be pushed ahead without the blades turning. With this in mind it is a simple matter to use the mower as a sort of "push cart" and replace a wheelbarrow for removing light trash such as grass cuttings, leaves, twigs or papers. A lawn mower equipped with rubber tires and ball bearings makes a mighty easy running trash barrow and the necessary carrier and fittings can be made at little expense.

The basket, or carrier is made almost completely of thin plywood and a few pieces of hardware. Use waterproof plywood so dampness or rains will not affect it. The size of the carrier will depend upon the type and width of mower. The basket shown fits an 18-in. machine with an [*Continued on page* 160]

Sand Bag Tree Protector

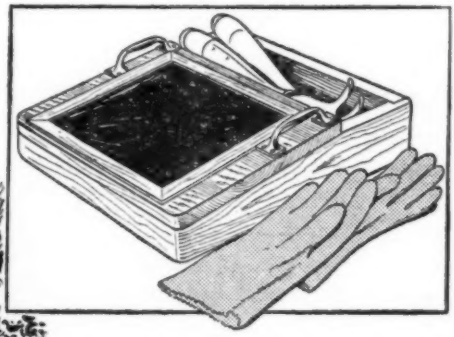
A CEMENT bag or other heavy cloth sack filled with sand and tied against the base of a tree will protect it from automobile damage. Such protection is suitable for trees located near driveways, during periods of heavy traffic; and for those in lawns that are being graded by power machinery. One nursery has a permanent installation of whitewashed sand bags to protect its trees. The bag can be secured by a cord sewn in end.



GARDEN

VICTORY GARDEN

Weeding and cultivating will become almost a pleasure with one of these V outfits.



Above: Kneeling pad is inclined at a convenient angle. Compartment holds tools, gloves, etc.

I UNDERSTAND that Contrary Mary in a moment of discouragement made some rather bitter remarks about the lone petunia among the cockle shells of her garden. At least the modern rhyme runs that way. Of course gardening like everything else can have its discouraging moments, but like everything else these moments are fewer when one has made adequate preparations. There will be more folk on their knees this summer than for a long time; housewives, stenographers, clerks, and overstuffed business men; pulling weeds, thinning and tending plots of lettuce, and radishes and onions—maybe spinach even. A fighting nation surely should have its spinach. Many of these people will not have a lot of time to spend in their gardens—a few minutes here and there, an hour in the morning, a couple perhaps in the evening. They may not have time to dress the part in blue shirts and overalls, but with one of the little garden boxes we describe here it will be easier to keep the knees clean and there will be less risk of rheumatism. Every craftsman can make one or more of these for the use of members of his own family and probably sell some to the neighbors.

Materials

So that the box will be light to carry around use a good clear soft wood—pine is probably best, though fir or basswood would be all right too. The greater part of the box is made of ¾" stock. An inside partition of ¼" plywood is used in one of the boxes and a piece of the same material is used on the bottom of both boxes. The top of the box is padded for kneeling, with a sponge rubber mat or with a pad covered with black oilcloth. A half pint of varnish or paint will be needed for finishing.

Construction

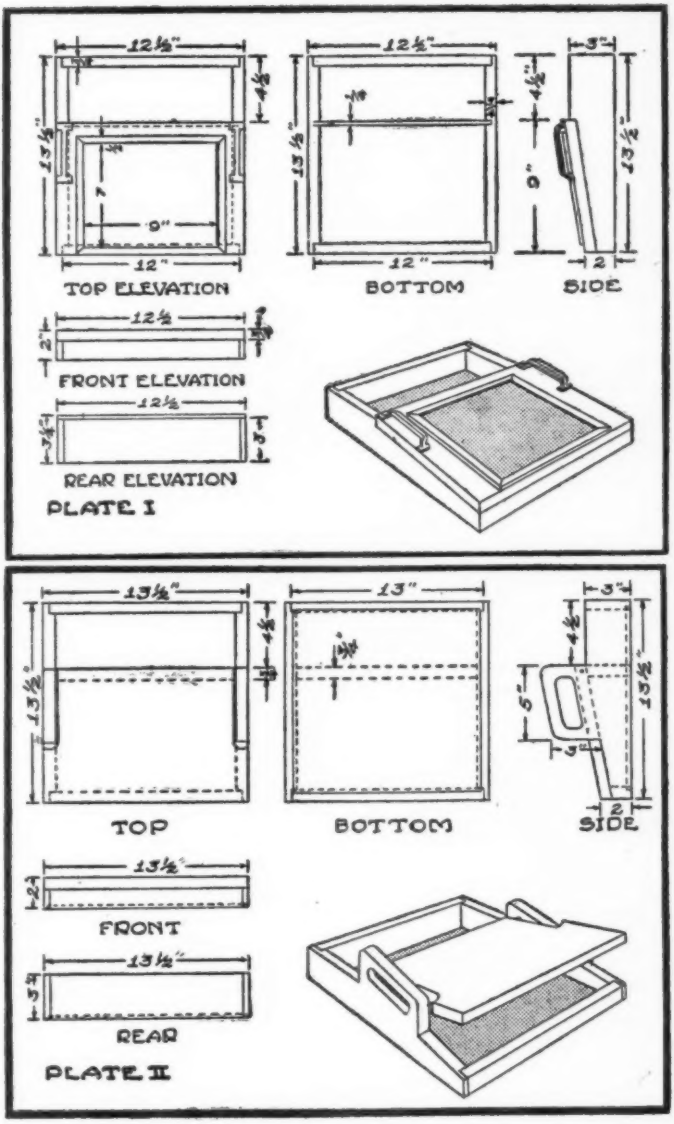
The first box, Plate I, is the simpler of the two. There are two side pieces to be cut. Get a piece of ¾" material 13½" long and dress it down to a 3" width. Four inches from one end start a taper and cut this toward the other so that the side piece is 2" wide at that end. The sketch shows how the lap joints are cut at the ends to receive the front and back cross pieces. A dado ¼" wide and deep is cut across the side pieces at the point where the taper starts—4" from the wider end of the pieces. This is to receive the piece of ¼" plywood which forms the front of the trowel box.

The front and back pieces are cut from ¾" stock also. These are 12" long, the front one 2" wide and the back one 3" wide. The top edge of the front cross piece will have to be cut at the correct angle to fit along the taper of the side pieces. A rabbet is cut along the bottom inside edge of the back piece to receive the ¼" plywood bottom of the trowel

WORK KIT

by Howard C. Ford

At right are shown details and dimensions of both the boxes described in the article. Use a light weight wood, such as white pine, for convenient carrying.

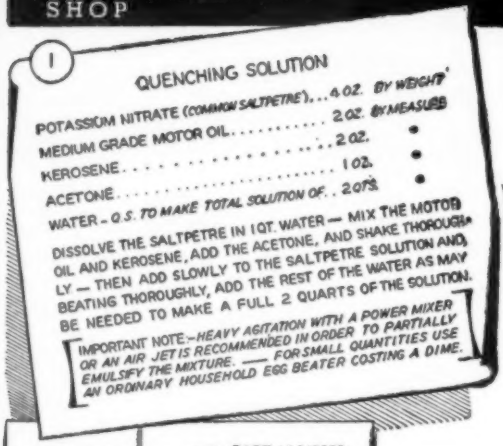


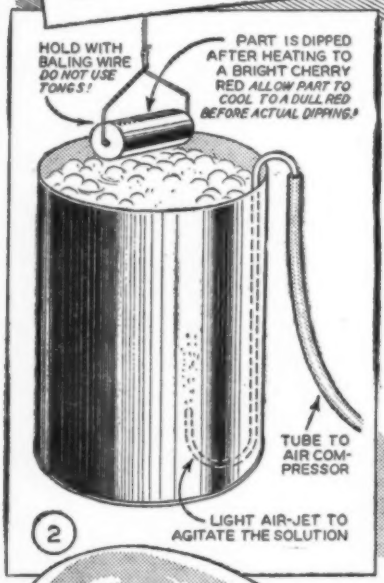
box. Two ½"x½" strips 4" long are nailed in position at the ends of the side pieces so that the plywood bottom can be nailed to these with small wire brads. The box bottom projects over the plywood inside section of the trowel box far enough so that it can be nailed firmly to the bottom of it.

The top piece is 9"x12" and of ¾" stock. Cut carefully to size, and smooth up all pieces before assembly. Countersink the heads of all the wire brads and later fill these holes with putty or wood filler. The handles of the box are screwed in position as indicated in the drawing. Use good grade screen door pulls for this.

The second box, Plate II, is similar to the first but has several added features — the handles are part of the side pieces and the top is hinged to lift up, revealing a storage place for garden gloves, seed packets or small tools. The side pieces will have to be cut from a ¾"x13½" piece 6" wide. The handle as indicated on the drawing is sawed out on a band saw, or with a jig saw or coping saw. Lacking these it can of course be cut roughly to size and shape with a hand saw and the top corners rounded with a chisel and a cabinet rasp and finished off with sandpaper. In this case a series of ¾" holes are bored in line for the slot of the handle and smoothed up with a chisel, cabinet rasp and sandpaper. The ends of the side pieces are cut to fit as with the first box but no dado is cut to receive the inside cross piece that forms the front of the trowel box. This piece is of ¾" stock cut to fit between the sides and nailed in place. The drawing indicates [*Continued on page 170*]

CASE HARDENING IN SHOP


1
QUENCHING SOLUTION
POTASSIUM NITRATE (COMMON SALTPETRE)... 4 OZ. BY WEIGHT
MEDIUM GRADE MOTOR OIL..... 2 OZ. BY MEASURE
KEROSENE..... 2 OZ. "
ACETONE..... 1 OZ. "
WATER - Q.S. TO MAKE TOTAL SOLUTION OF.. 2 QTS. "
DISSOLVE THE SALTPETRE IN 1 QT. WATER — MIX THE MOTOR OIL AND KEROSENE, ADD THE ACETONE, AND SHAKE THOROUGHLY — THEN ADD SLOWLY TO THE SALTPETRE SOLUTION AND, BEATING THOROUGHLY, ADD THE REST OF THE WATER AS MAY BE NEEDED TO MAKE A FULL 2 QUARTS OF THE SOLUTION.
IMPORTANT NOTE:-HEAVY AGITATION WITH A POWER MIXER OR AN AIR JET IS RECOMMENDED IN ORDER TO PARTIALLY EMULSIFY THE MIXTURE. — FOR SMALL QUANTITIES USE AN ORDINARY HOUSEHOLD EGG BEATER COSTING A DIME.

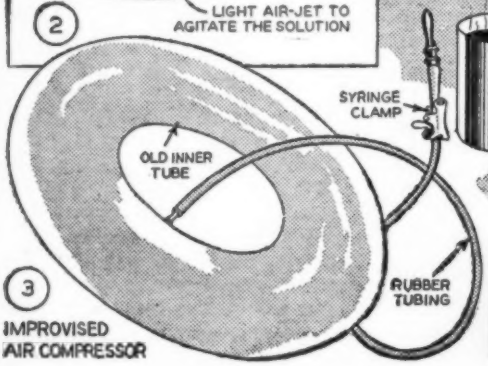

HOLD WITH BALING WIRE DO NOT USE TONGS!
PART IS DIPPED AFTER HEATING TO A BRIGHT CHERRY RED ALLOW PART TO COOL TO A DULL RED BEFORE ACTUAL DIPPING.
TUBE TO AIR COMPRESSOR
LIGHT AIR-JET TO AGITATE THE SOLUTION
2

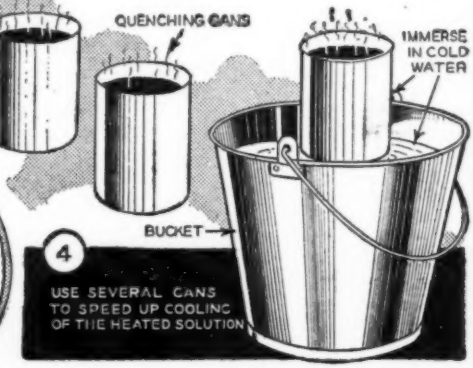
MANY small manufacturers, subcontractors on defense work, toolmakers, model makers and others would find it desirable to finish certain small steel parts in the beautiful deep mottled color effects often seen on the products of our best tool factories; but hesitate to attempt it in the belief that this method involves the use of costly equipment and scientific knowledge—which is far from true. The following method is giving results in one shop fully equal to the finest color hardening of the most expensive precision tools — and cost is almost negligible.

Case hardening is adapted only to relatively soft stock such as cold rolled or machinery steel, or forging stock. It leaves the outer surface almost glass hard to resist wear, while the inner body of the metal remains soft, for strength. It is not recommended for tool steel parts, as it would leave them too hard and brittle.

The process consists essentially of heating the parts to a bright cherry red, in potassium cyanide, and quenching them in the solution given in Fig. 1, which is meantime agitated by means of an air jet (Fig. 2).

The cyanide on the work tends to "kill" the quenching solution in a few dozen to a few hundred passes—depending on size of work. For this reason it is advisable to use the small practical quantities of solution at one time—say 1 quart of solution for parts weighing from 1 to 3 ounces each, and proportionate amounts for other sizes. A rather narrow quenching can should be used, to gain as much depth as possible while quenching.



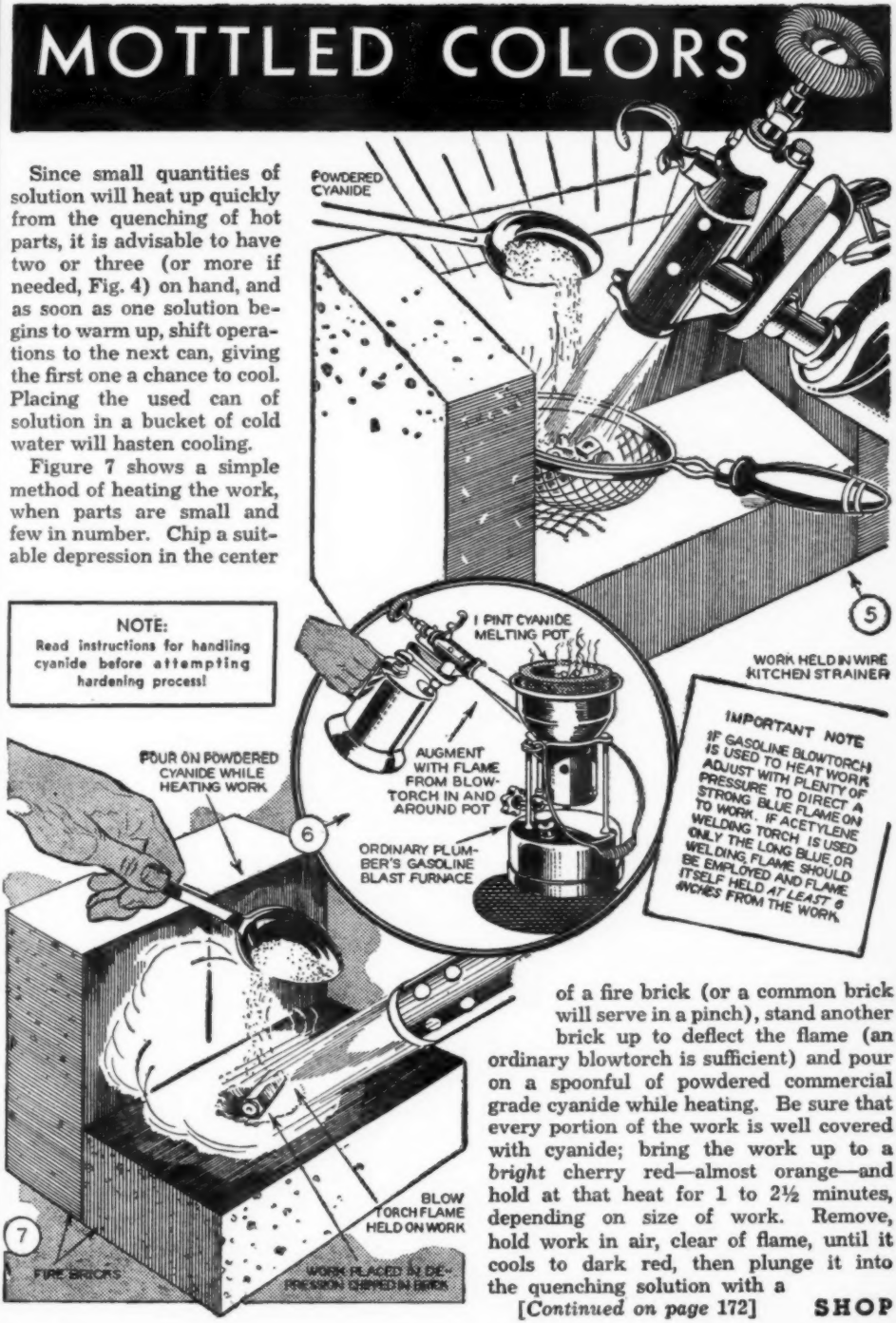


MOTTLED COLORS

Since small quantities of solution will heat up quickly from the quenching of hot parts, it is advisable to have two or three (or more if needed, Fig. 4) on hand, and as soon as one solution begins to warm up, shift operations to the next can, giving the first one a chance to cool. Placing the used can of solution in a bucket of cold water will hasten cooling.

Figure 7 shows a simple method of heating the work, when parts are small and few in number. Chip a suitable depression in the center of a fire brick (or a common brick will serve in a pinch), stand another brick up to deflect the flame (an ordinary blowtorch is sufficient) and pour on a spoonful of powdered commercial grade cyanide while heating. Be sure that every portion of the work is well covered with cyanide; bring the work up to a *bright* cherry red—almost orange—and hold at that heat for 1 to 2½ minutes, depending on size of work. Remove, hold work in air, clear of flame, until it cools to dark red, then plunge it into the quenching solution with a

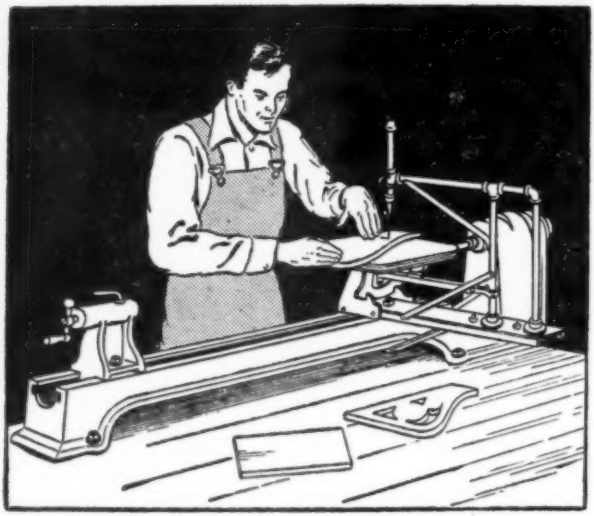
[*Continued on page* 172]


POWDERED CYANIDE
5
WORK HELD IN WIRE KITCHEN STRAINER
NOTE:
Read instructions for handling cyanide before attempting hardening process!
1 PINT CYANIDE MELTING POT
AUGMENT WITH FLAME FROM BLOW-TORCH IN AND AROUND POT
ORDINARY PLUMBER'S GASOLINE BLAST FURNACE
IMPORTANT NOTE
IF GASOLINE BLOWTORCH IS USED TO HEAT WORK ADJUST WITH PLENTY OF PRESSURE TO DIRECT A STRONG, BLUE FLAME ON TO WORK. IF ACETYLENE WELDING TORCH IS USED ONLY THE LONG BLUE OR WELDING FLAME SHOULD BE EMPLOYED AND FLAME ITSELF HELD AT LEAST 6 INCHES FROM THE WORK.
POUR ON POWDERED CYANIDE WHILE HEATING WORK
6
BLOW TORCH FLAME HELD ON WORK
7
FIRE BRICKS
WORK PLACED IN DEPRESSION CHIPPED IN BRICK

SHOP

JIG SAW IS LATHE ACCESSORY

by A. G. Mather

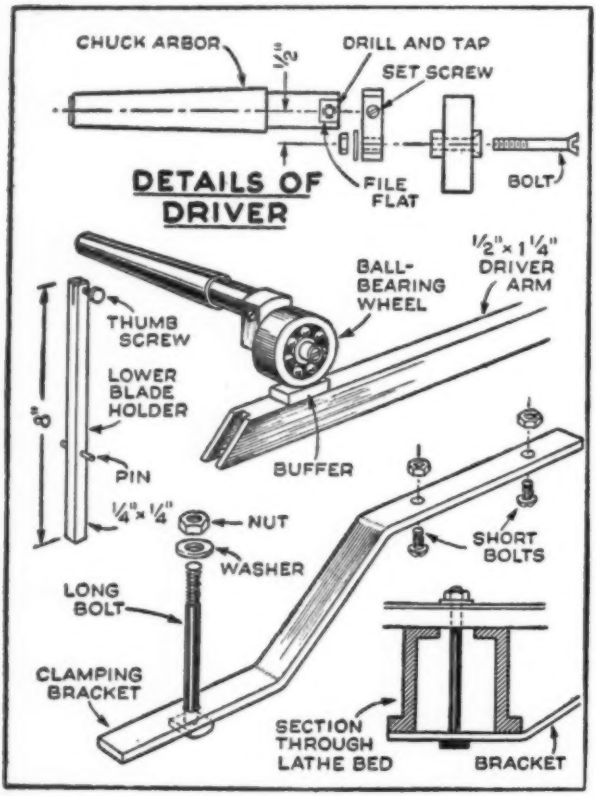


THIS rugged jig saw will cut soft woods up to three inches in thickness and hard wood up to one and a half inches in thickness, with excellent results. The galvanized pipe used is ¾ inch in size, and forms an extremely rigid frame. The entire outfit clamps easily to the lathe bed, and receives its motion from the eccentric which fits into the live head of the lathe. An ordinary center of the proper taper to fit the lathe is all that is needed to make the eccentric shaft. A chuck arbor will serve the same purpose. End is ½ inch in diameter.

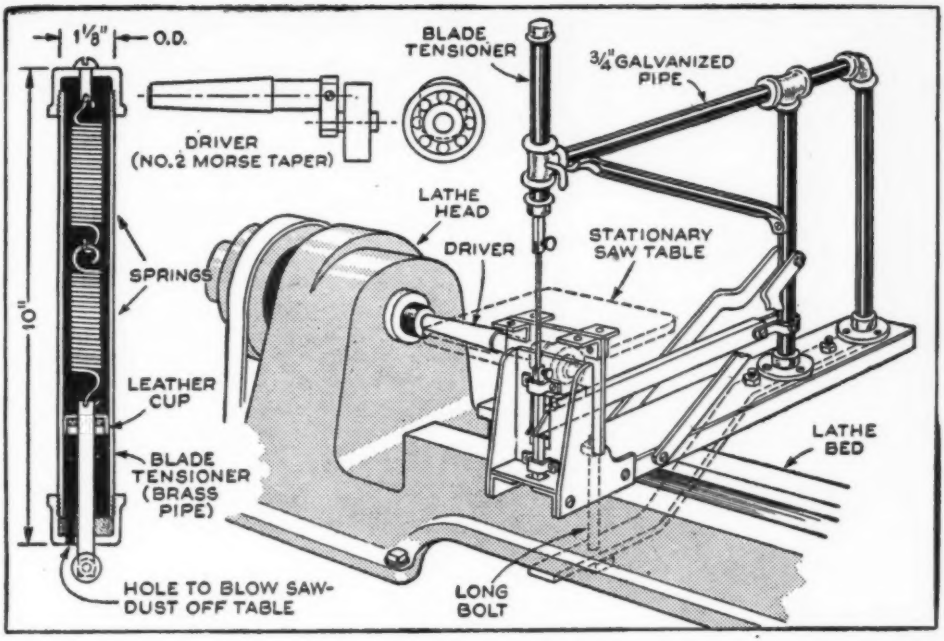
To mount the crank arm on the end of the center, grind off the point and also grind a "flat" on the cylindrical ½ inch portion of the arbor just behind the end. The crank arm is then drilled to make a snug fit over the chuck arbor. A set screw in a tapped hole in the crank arm holds it firmly in place. Naturally, the set screw should seat on the flat portion ground on the center.

As the crank arm may be made of relatively soft steel (not necessarily hardened like the arbor) it can be easily drilled for the crank pin at the other end. This pin is easily made from an ordinary bolt. A roller skate wheel or an old auto generator bearing should be used for the roller to actuate the saw arm.

The brass pipe "cylinder" which contains the springs that return the saw blade after the eccentric pulls it down, also provides a stream of air to clear sawdust with each stroke. A leather plunger like that in a bicycle pump accomplishes that helpful purpose.



Strap iron bracket at left braces saw on lathe. Detail shows crank eccentric and arm construction. Skate wheel can be used.

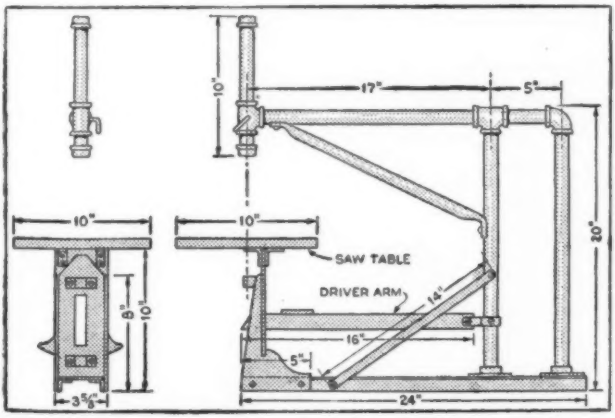


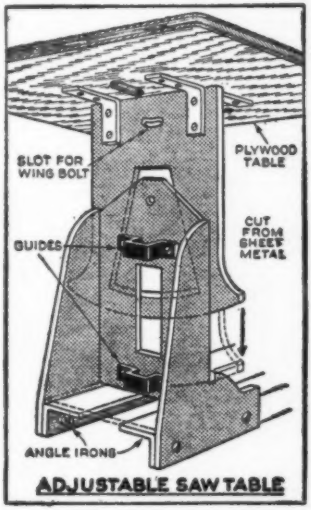
This entire blade tensioner unit can be adjusted up or down in its pipe-tee mounting by loosening the thumb screw that holds it in place. By this method the saw can be adapted to long or short blades and also given a different tension.

The lower part of the frame is made chiefly from angle iron and flat plates. A little welding will simplify the job, although much of it may be bolted. If welding equipment is not at hand, auto frame parts from the local junkyard will be a great help. The upright to which the adjustable saw table is attached, can be made from the reinforcements used on many auto frames where cross pieces are joined to side members. Naturally, the welded built-up job makes a neater finish.

The lower blade holder is made from an 8" length of ¼" square steel. The actuating arm of the saw [*Continued on page 170*]

Above: Perspective of saw mounting. *Below:* Tilt-table and frame details and dimensions.



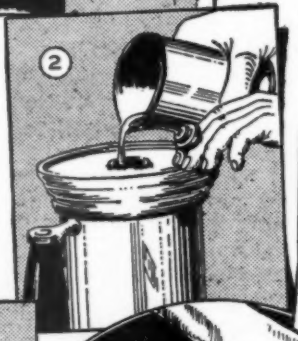


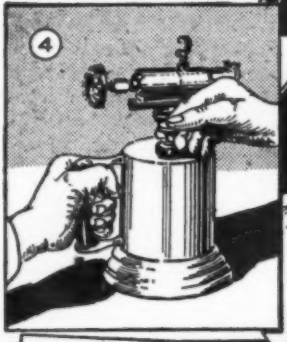
PROPER CARE

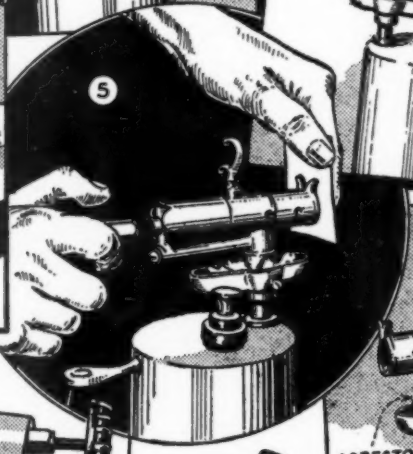
THESE pointers for blow torch users will keep many an old torch in operation for years to come, and also prevent accidents. Follow them and you won't have to worry about replacing yours for the duration, at least.

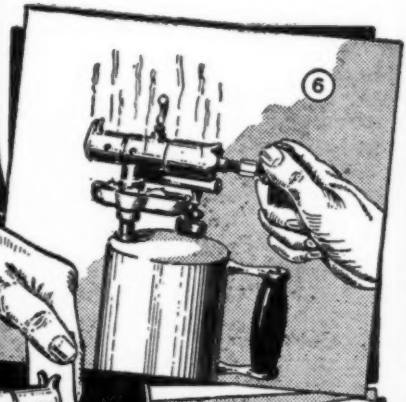
Figure 1 shows a simple but handy filling stand for your torch. Four dowels toed in toward the top, are glued into holes in a small wooden base. The torch may then be inverted on this stand for filling, with less chance of spilled gas than when simply held by hand during the filling.

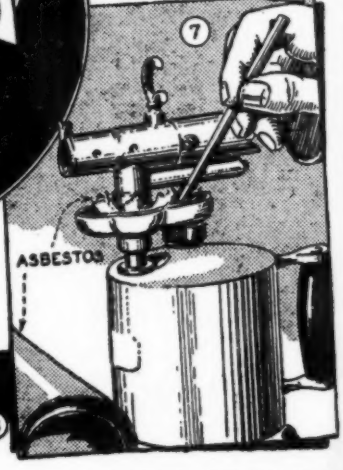
Another filling tip is illustrated in figure 2, where the shop worker is holding the filler cap of the torch between his fingers while the fuel is poured into the opening. This practice of never setting down the cap prevents the cap from picking up bits of dirt and grit from the shop floor or bench. Foreign matter of this type might easily clog the torch parts, especially the generator. Chemists follow this practice to prevent the accidental introduction of impurities in their chemicals, and to prevent damage to table surfaces from acid-wet bottle stoppers.

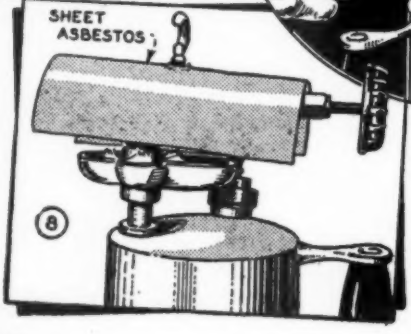












FOR THE BLOW TORCH

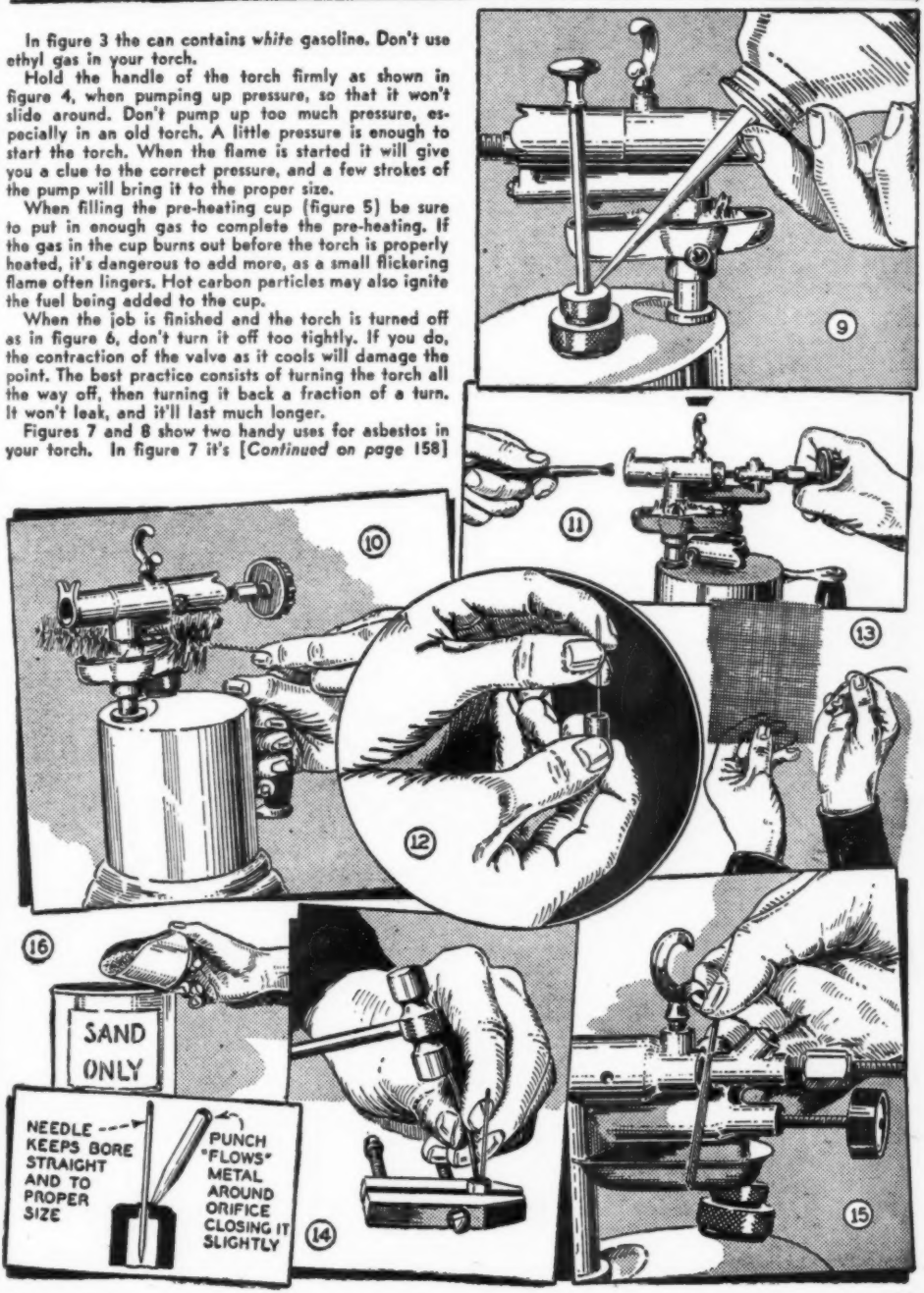
In figure 3 the can contains *white* gasoline. Don't use ethyl gas in your torch.

Hold the handle of the torch firmly as shown in figure 4, when pumping up pressure, so that it won't slide around. Don't pump up too much pressure, especially in an old torch. A little pressure is enough to start the torch. When the flame is started it will give you a clue to the correct pressure, and a few strokes of the pump will bring it to the proper size.

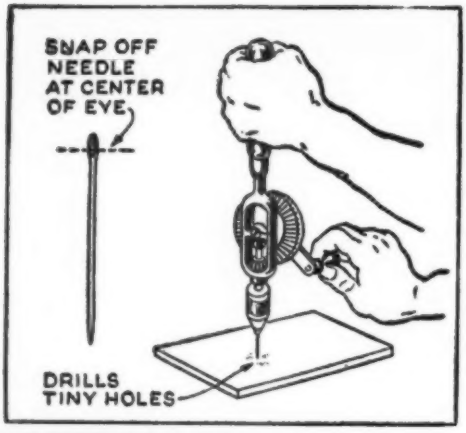
When filling the pre-heating cup (figure 5) be sure to put in enough gas to complete the pre-heating. If the gas in the cup burns out before the torch is properly heated, it's dangerous to add more, as a small flickering flame often lingers. Hot carbon particles may also ignite the fuel being added to the cup.

When the job is finished and the torch is turned off as in figure 6, don't turn it off too tightly. If you do, the contraction of the valve as it cools will damage the point. The best practice consists of turning the torch all the way off, then turning it back a fraction of a turn. It won't leak, and it'll last much longer.

Figures 7 and 8 show two handy uses for asbestos in your torch. In figure 7 it's [*Continued on page 158*]



SHOP SHORTCUTS

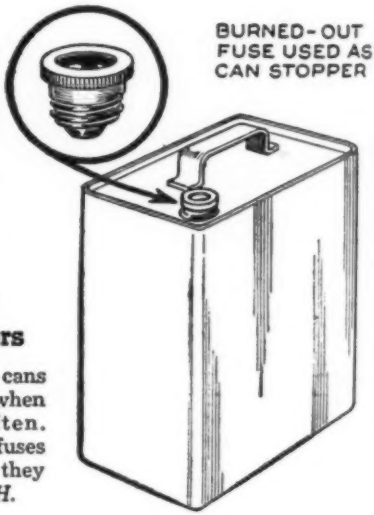


Tiny Drills From Needles

AS DRILLS of extremely small size are easily broken, the craftsman frequently finds himself without a replacement. Ordinary sewing needles found around the house in a variety of sizes, can be converted to drills for light metal, wood or plastic work, by simply breaking the eye in half and placing the pointed end in the chuck.—*A. H. W.*

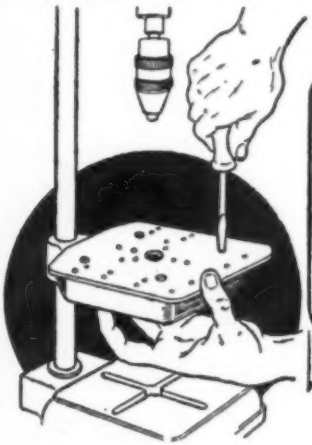
Drill Press Vise From V-Pulley

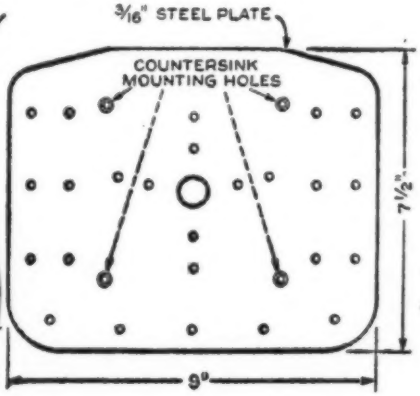
A POLISHING head arbor makes a handy drill press vise when a pulley is set-screwed on it for a base.



Burned Out Fuses Make Can Stoppers

THE stoppers of oil cans frequently are lost when the can is used often. Burned out household fuses are a good substitute, as they can be screwed in.—*F. H.*



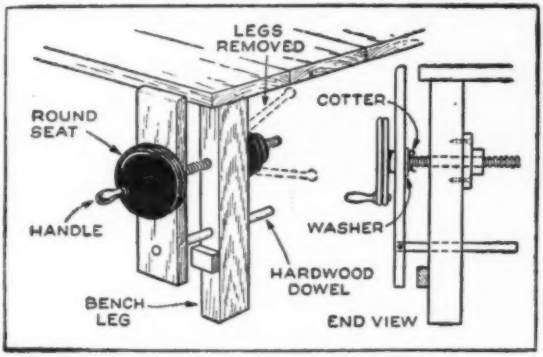


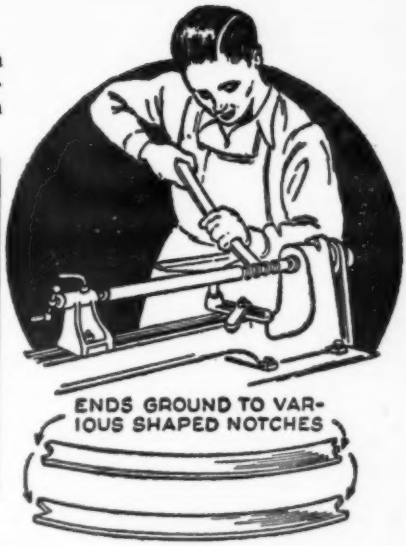
Big Table For Drill

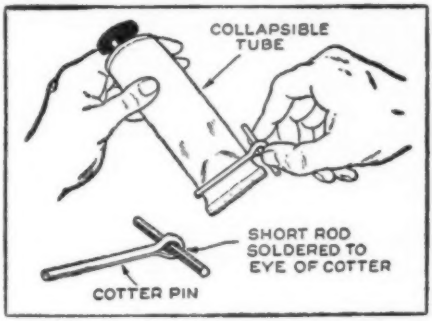
IT IS often desirable to have a larger table on the drill press. A piece of $\frac{3}{16}$" steel plate fastened over the table as shown with countersunk bolts, does the trick. Drill a large center hole and also a number of smaller ones in line with the slots in the original table.

Bench Vise From Piano Stool

AN OLD adjustable piano stool can be made into a rugged bench vise as shown. The legs are removed, and the stool mounted as indicated, with a handle attached to the seat.—*A. H. W.*







Cotter Pin Tube Winder

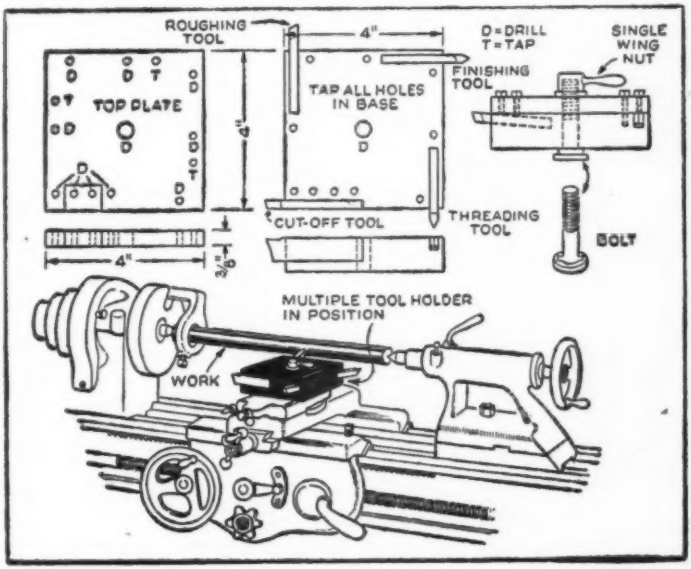
IF A cotter pin is used as shown for a winder on a collapsible tube, there will be little waste. Solder a short rod through the eye of the cotter pin as a key. —*A. H. W.*

Car Spring Tool

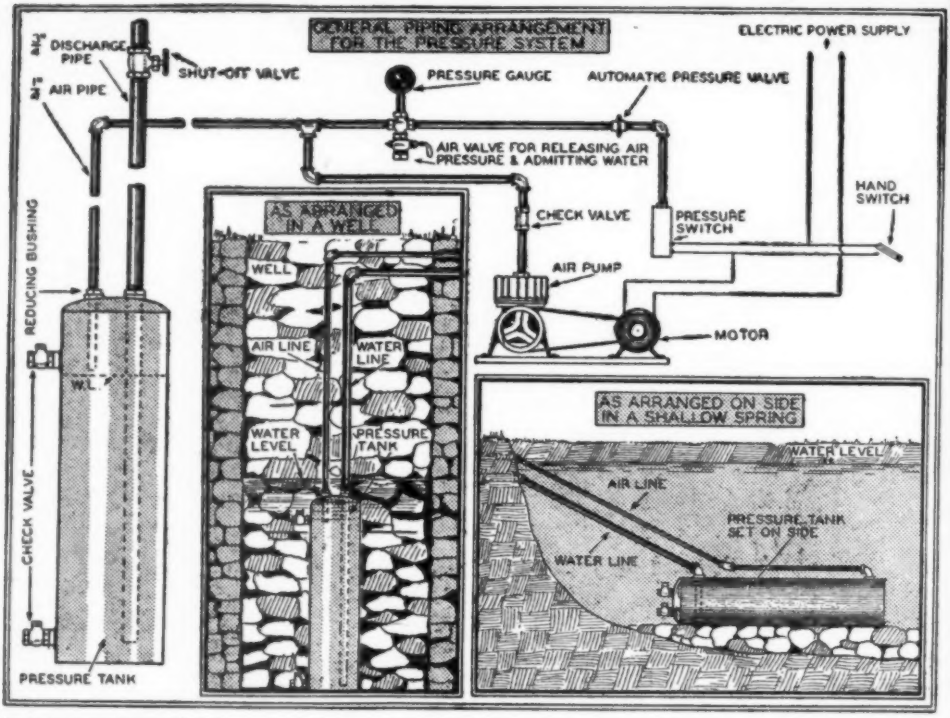
AUTO spring leaves may be cut to proper length and ground to desired shape on the ends to turn various notches in woodwork. Sharpen as a chisel and use as shown.—*A. H. W.*

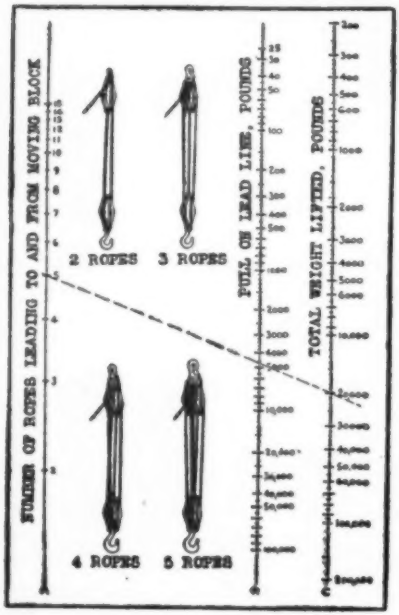
4-Tool Holder

A SQUARE block of cast iron forms the main body of this turret type lathe-tool holder. It should be thick enough to permit tool tips being lined up on center line of work. Roughing, finishing, threading, and parting tools can be mounted and used in quick succession simply by loosening and turning the holder. Top plate is ⅜". Tools are held in holes or channels cut in the base block, as shown in sketch.—*W. F. K.*



TAP WATER FROM WELL





BY UTILIZING a good but perhaps old hot water boiler or small pressure tank and a suitable air pump one can construct a running water system for the farm or camp that will provide all the qualities of a manufactured system. Anyone who can cut and thread pipe can build it.

As an example—suppose you have a well, not too deep, on the premises. Prepare the tank as follows. In the two side openings [*Continued on page* 166]

Block And Tackle Problems

THE chart at left simplifies block and tackle problems so that anybody can understand and solve them without doing any complicated figuring. The chart takes care of lifting any weight up to 200,000 pounds, which is more than most of us are ever called on to lift.

For example, what pull must be given to the "lead line" to lift the weight you want to lift? The pull is found in column B. Let us say that you want to lift 20,000 pounds and you are contemplating the purchase of a "five rope" tackle. In that case run a straight line through the 5 in column A and the 20,000 in column C and column B tells you that the rope must be strong enough to resist a pull of 4,700 pounds.

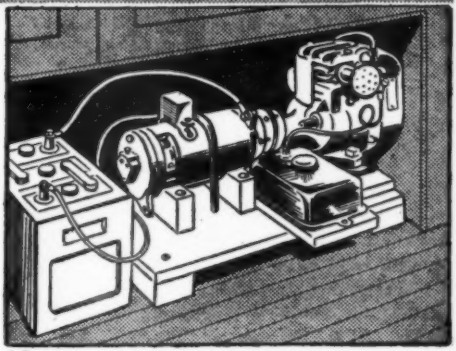
The chart takes into account the friction of the ropes and sheaves. Remember, in buying ropes for your tackle, the rope must be strong enough to resist the "maximum pull," which is the pull on the lead line, column B.—*W. F. Schaphorst.*

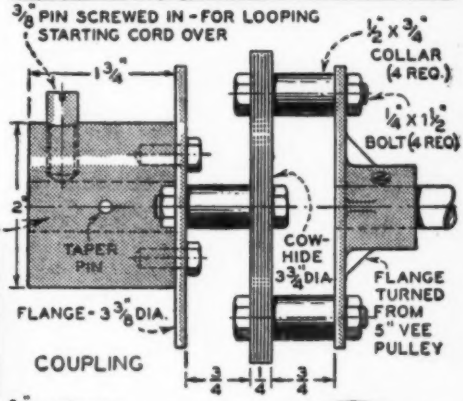
COMPACT BATTERY CHARGER

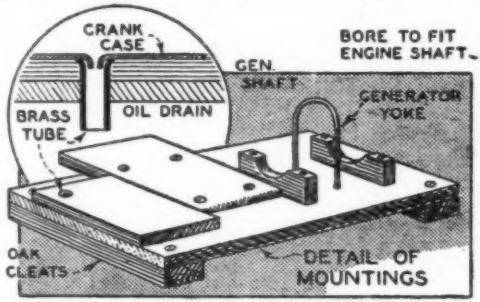
WITH a small, one-half horse-power utility engine and a rebuilt automobile generator a very compact and highly efficient battery-charging unit can be built. Practically the only items to be made in the home workshop are the wooden base and a universal coupling. These rebuilt auto generators are virtually new with the exception of the iron shell, and usually are guaranteed by the dealer.

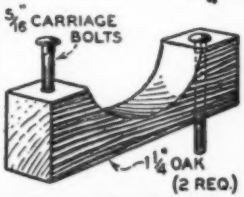
Any half-horse-power gasoline engine, whether two or four cycle with built-in magneto and blower or fan, is satisfactory, but the upright type is preferred as it is more compact in over-all dimensions.

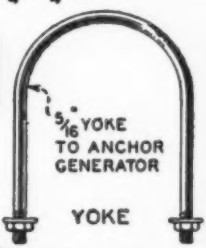
Make the base of hardwood, laid out to accommodate the equipment you intend to use. In the original a Briggs-Stratton four-cycle, one-half horsepower engine is hooked up with a Chevrolet 1926 generator. The latter is mounted [*Continued on page* 164]

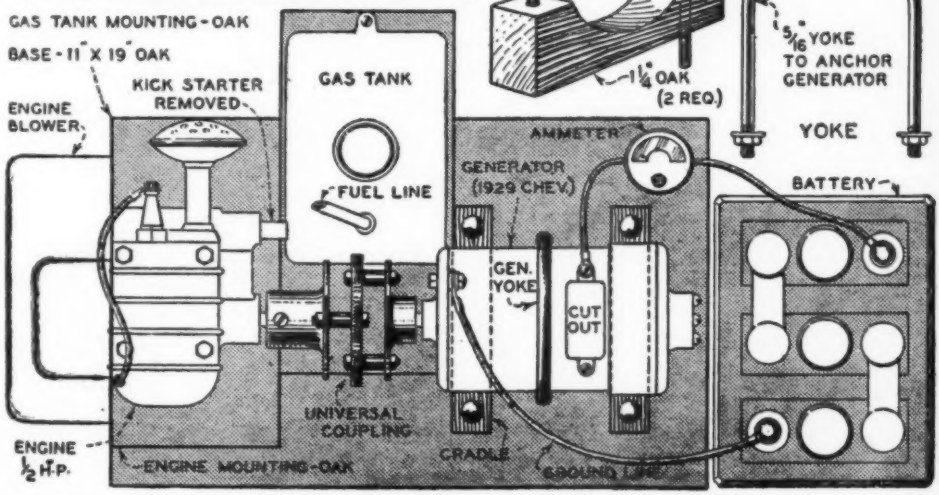






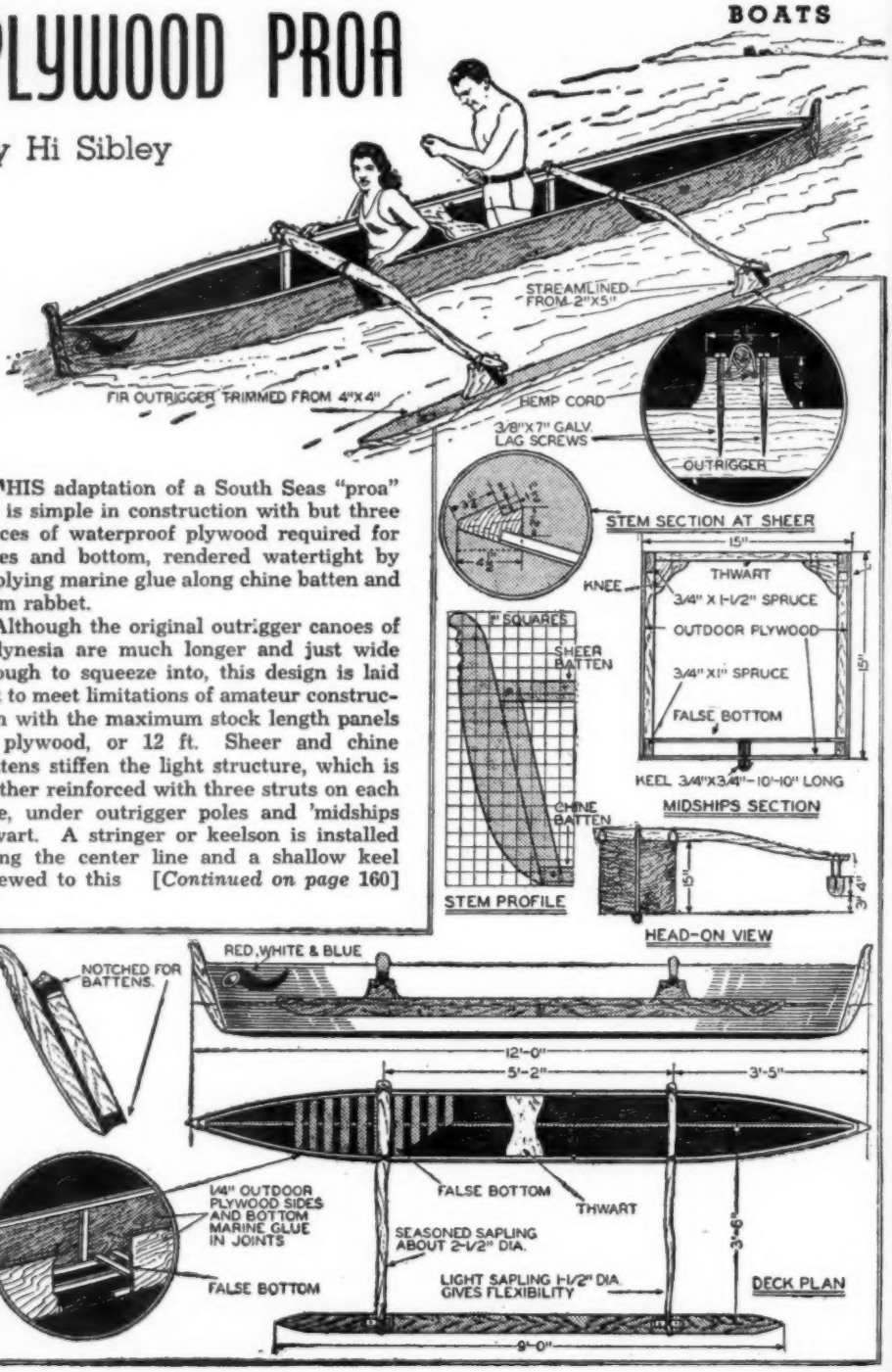






PLYWOOD PROA

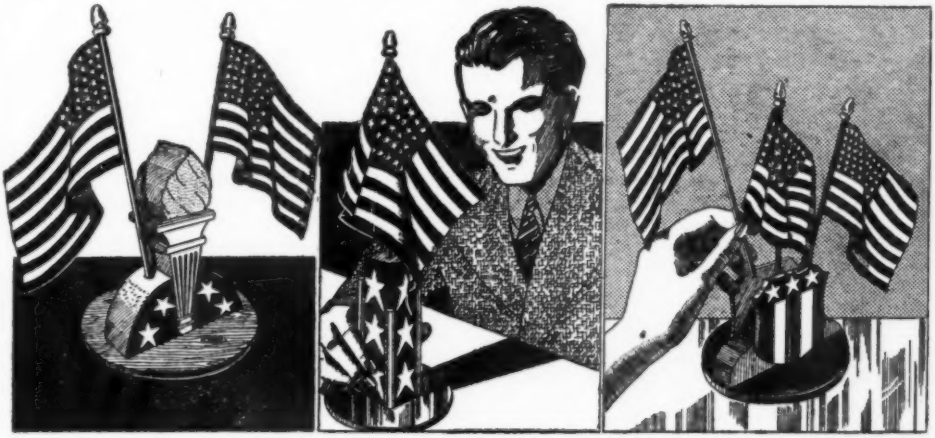
by Hi Sibley



THIS adaptation of a South Seas "proa" is simple in construction with but three pieces of waterproof plywood required for sides and bottom, rendered watertight by applying marine glue along chine batten and stem rabbet.

Although the original outrigger canoes of Polynesia are much longer and just wide enough to squeeze into, this design is laid out to meet limitations of amateur construction with the maximum stock length panels of plywood, or 12 ft. Sheer and chine battens stiffen the light structure, which is further reinforced with three struts on each side, under outrigger poles and 'midships thwart. A stringer or keelson is installed along the center line and a shallow keel screwed to this [*Continued on page* 160]

SHOW YOUR COLORS for the Fourth



Old Glory flies in patriotic splendor from these colorful holders in the true spirit of '76.

Torch design shown at left, and column and shield type holders at center and right are made from scrap wood. Jigsaw or coping saw is used for cutting, inexpensive paint for finishing.

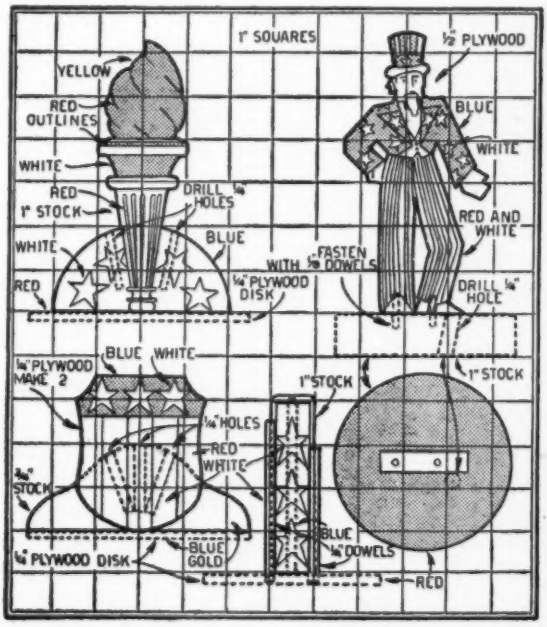
THESE appropriate holders make it easy to display the flag in your home, office, or store. Easily constructed, they hold small flags which usually are attached to a 10½" staff.

The torch design is traced to 1" stock and jigsawed out. Two holes are drilled on either side of the torch, as indicated by dotted lines on the squared drawing, and a ¼" plywood disk 5" in diameter nailed to the bottom.

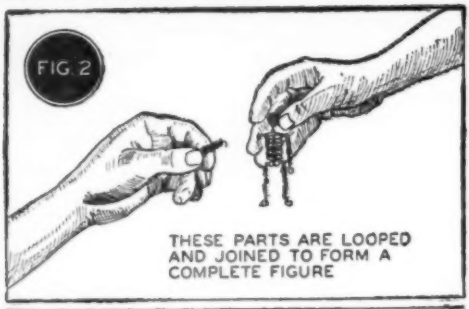
The middle section of the holder for three flags is cut first from ¾" stock and the three holes drilled for the flags. The shields are traced to ¼" plywood, jigsawed out, and glued one on each side of the ¾" section. The base, a disk of ¼" plywood 5" in diameter, is then nailed to this middle section.

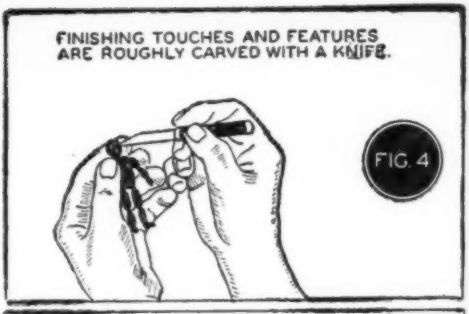
Uncle Sam is cut from ½" plywood, and attached to a 4" disk cut from 1" stock by two ⅛" dowels glued into holes drilled in the legs and in the base. A ¼" hole is drilled in the base in front of the figure to hold the flagstaff.

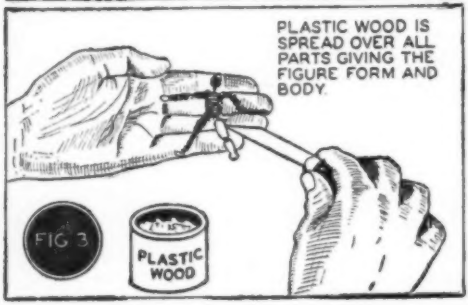
To hold one flag, a ¼" hole is drilled through a section of 1"x1" stock 4" long. The edges are planed off and it is nailed to a 4" disk of ¼" plywood. Holes are drilled in the base at each corner of this post, and ¼" dowels glued [*Continued on page* 172]

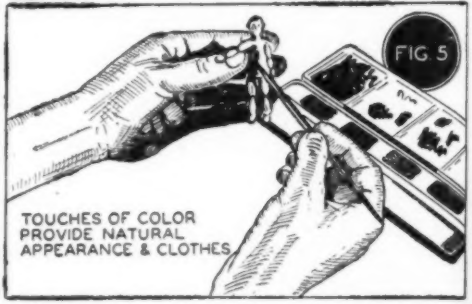


Reproduce squared outlines above on wood, then jigsaw out. Soft wood will do.









Lillipuppets

[*Continued from page* 104]

may bind. Twist each loop one or two turns to hold it in place, but make sure not to shorten the distance between loops. Next bring both ends of the wire back to the center below the neck loop and twist them together, making a spine for your figure.

Allow short extensions from the spine and form two hip or leg loops, twisting each so it will keep its shape and position. You have now made the complete body frame, and the remaining ends of wire will be used to build the body out to give it the correct thickness in all directions. Carry each end back in a wide curve to form a seat. Then start wrapping the balance of the wire in wide loops to shape the body. These loops do not have to be very close together, as the later covering with plastic wood will hold them rigid.

Notice that you have made the body with five closed loops. Accordingly, each part which joins the body must have an open end to fit into these loops.

The head and the controller are made as a unit, joined by a single straight wire. This priciple is borrowed from the folk marionettes of old Czecho-Slovakia, and makes Lillipuppets foolproof and easy to manipulate. First make the controller bar from a 20" length of wire. Straighten this wire and bend it double. Starting with the middle, where you doubled the wire, wrap a tight coil, using a large nail or any small round object as a core. This coil of doubled wire should be about an inch long and about ¼" in diameter. Allow the two free ends to extend about a half inch from either side of the end of the coil, and form a loop in each, twisting the loops and snipping away any left over wire. The controller bar will later be used to make the figure walk, and if the loops are too far apart, he will waddle instead.

While the head itself does not require much wire, remember that it is just a continuation of the controller, so start with about a 24" length. At one end bend a partial loop which will later attach the neck, then another bend to indicate the top of the head. Twist the long wire right down toward the neck loop in a tight coil, then start back to the top of the head, but now make the coils large and looser to shape the head. Never mind ears, nose, etc. These will be put on later with plastic wood. Just get a good egg-shape to the head.

As the long wire completes the head it is allowed to continue straight up from the pate for about 5". Then make a sharp right-angle bend. At this point, slide the coil of your already completed controller bar onto the wire, for it is about to be anchored into place. Leave enough horizontal wire so that the controller bar can turn without binding, then make a right-angle bend downwards. This goes down just about ¼" and a loop is twisted in place. This loop will later be used to attach the backstring, and also forms a convenient hook when you wish to hang the figure up. The rest of the wire comes back up in a curve, straightening over the controller bar, then down in front of it, and a final loop is made, and any extra wire snipped away. The upper wire should not bind the con-

troller bar from turning easily, but the front part will keep it from making more than a half revolution. If you wish, you may now attach the controller and head to the body. Just close the neck loop with the pliers, but be sure that the head can bend or turn freely in any direction. Also be sure that when hung from the controller the body hangs straight and true. The last loop you made in the controller should be in front.

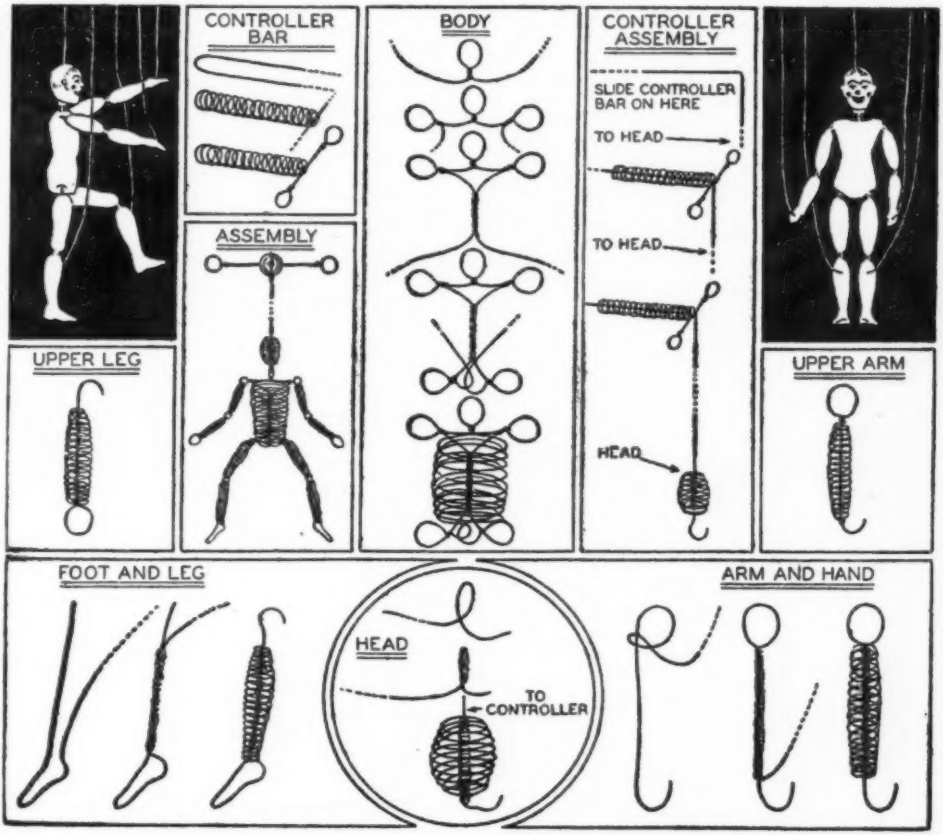
Now that you have made the controller, head and body you will find the other parts quite easy. However, when you make arms and legs, use as much wire as possible, so as to make them heavy. The more weight in the limbs, the better your Lillipuppet will perform. You do this by wrapping your coils as closely together as you can.

Upper arms and upper legs are all made in just the same way, using the diagrams to assure the correct length. Leave one loop open for attaching, a closed loop at the other end. Then wrap wire in tight coils along the length and between loops. Then go back and wrap a second layer of coils. In the case of legs, wrap this second layer slightly looser, because legs are thicker than arms. In the case of such small figures there is little difference between rights and lefts, so make them the same.

For the lower arm, form a larger loop than usual to represent the hand. Then wrap as usual, remembering to keep the wrist thin. For lower legs make a large loop to represent the foot, and bend it almost at right angles from the leg.

Assemble all your parts, making sure that all loops are closed, yet not so tight as to restrict free action of all members. Your Lillipuppet figure is now ready for its covering of plastic wood.

Take some plastic wood from a tube or can on the blade of a knife and spread it all over the figure (Fig. 3), much as you would butter a slice of toast. As it starts to set, push it in between the wire coils with [*Continued on page* 168]



Details of wire base or "skeleton" for figures is shown above, together with controller assembly, integral with head. The idea of incorporating the joints right into the construction is entirely original with Lillipuppets, and circumvents one of the most difficult parts of conventional marionette making.

THE SCHOOL SHOP

Conducted by Frank Petraglia

Shop Instructor, Samuel Gompers Industrial High School
New York City

The School Shop School Year In Review

THIS has been a great school year, and all you fellows may well point with pride to the part which the vocational and industrial arts school shops have played—and will continue to play—in the war program. The work of school students in war production needs no repetition; newspapers have told the admirable story of school shops on the production line. This useful work will continue; and every school and home-workshop can justifiably feel satisfaction in the thought that in the pursuit of his hobby he is thereby keeping himself and his skill ready for action when called upon.

Beyond this, the end of the school year marks another event of note to MI readers. The School Shop rounds out its first school year! Last September saw our debut in these pages—the first department of its kind ever to appear in a nationally prominent magazine. If this occasion calls for a demonstration from the cheering section, your School Shop editor knows that those cheers are for the readers and editors of MECHANIX ILLUSTRATED who arm in arm, so to speak, took the step of introducing this department. Cheers, too, for the staff of School Shop Reporters, and for those other fellows whose cooperation in submitting ideas and suggestions has helped to sustain and build this department.

And, finally, let us give the heartiest cheers to the thousands of vocational school students about to be graduated. Ten thousand or more young men, graduating as full-fledged apprentices in a hundred different occupations, will soon be converting the learning processes of their schools into the industrial processes of production. Go through the alphabet of trades, from Aviation to Welding, and you will find these trained young mechanics skilled for the job to be done. As airplane engine men, carpenters, radio mechanics, metal workers, electricians, electroplaters, foundry-workers—to mention just a few of the fields for which they are qualified—these fellow school-shoppers, before the month draws to a close, will be right out there in the thick of Industry's battle. Good luck to them!

STUDENTS' PROBLEM BOX

1. Q.—When sawing damp wood, a saw has a tendency to jam in the cut. How can this difficulty be overcome?—*A. M.*

   A.—Anything which will serve as a wedge to spread the sides of the cut will help. A table knife will usually do. While sawing, move the knife along the cut, within a few inches of the saw blade.

2. Q.—Can dry cells be renewed so that they will give appreciable extra service?—*K. S. B.*

   A.—Yes. Drill six one-quarter inch holes around side of the zinc container, ½" from bottom. Also drill another row half way up the side. Place cells in a solution of sal ammoniac for 48 hours. On removing, plug the holes with hard soap.

3. Q.—Is there some way of preserving the binding of books, such as those used in the workshop, which are subject to hard wear?—*C. M.*

   A.—A public library uses the following method: brush on a coat of white shellac. After drying, apply furniture or auto wax. This finish resists constant handling and is easily cleaned.

4. Q.—How may thin nails be driven into hard wood surfaces to prevent bending or breaking?—*G. Y.*

   A.—This may be done by embedding the nail through the center of a soft cork. The cork will compress enough to allow the nail to be driven forward without buckling or breaking.

5. Q.—Drawer pulls are usually in the way at the front of a workbench. What can be substituted for them?—*R. H. W.*

   A.—Cut a half-round hole through the front board of the bench just below each drawer. This gives a good grip on the bottom lip of the drawer.

6. Q.—Can you recommend a good beginners' book on workworking tools, processes, etc.—*R. R.*

   A.—An excellent book is "How To Work With Tools and Wood." Published by Stanley Tool Co., New Britain, Conn. Price $1, postpaid.

Prize For Puppets

HERE'S a chance for you clever-fingered students to win a nice cash award! A prize of $5 will be given to the craftsman who submits the best photo of the best Lillipuppet Theater, complete with at least two puppets, made from the article starting in this issue on page 102. Address School Shop Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y. . . . . As the School Shop goes into its second year next month you'll notice a few changes and improvements in both layout and contents. We won't tell you what they're going to be but we hope you'll like them. . . .

Shop Instructors News Notes

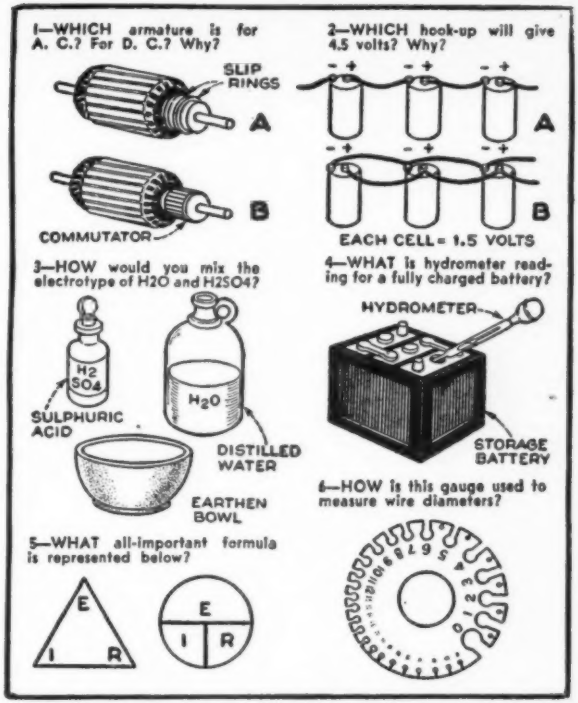
THE United Air Lines Transport Corp. has announced their new enlarged 1942 Mainliner Teacher's Kit which contains a great variety of printed pictures, airline maps and colorful poster material. This big bundle is available for 25 cents.

Additional visual aids for high-school war-aviation courses may be obtained by addressing the Visual Aid Program, WPA, 46 N. Cameron St., Harrisburg, Pa. Attention: L. B. Sisson.

Six one-reel, all-color sound moving pictures designed to accelerate the training of welding operators are now under way for the General Electric Co. The series is entitled "The Inside of Arc Welding." Upon completion, the pictures will be made available to public, private, and industrial welding schools.

Teachers of auto mechanics who are interested in gas, oil and rubber conservation may obtain GM's motion picture, "It's Up To Us" free of charge. Showing time, 10 minutes. Inquire at General Motors Public Relations Dept., 1775 Broadway, New York City.

Shatterproofing school windows has been the subject of much study. For information along these lines write the Arabol Mfg. Co., New York City.



HOW MANY OF THESE ELECTRICAL QUESTIONS CAN YOU ANSWER? Here's a chance for you electrical students to go to town on this month's Craft Test. If you get stuck turn to page 176 for the correct answer.

Flashes From The Reporter

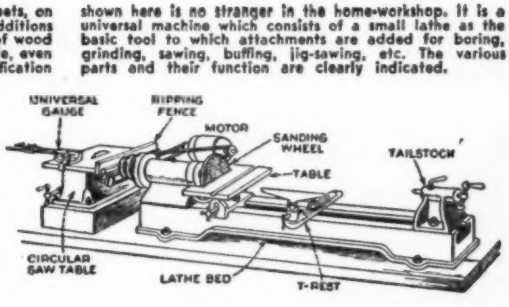
HERE are a few new reporters whom we ought to welcome. From Downey, Iowa, we hear from Arlo Stahle, West Liberty High School. William C. Millhoff, Clayton H. S., Clayton, New Mexico. . . . From Windsor, Ontario, W. C. Crosbie of Wakerville Vocational writes some nice info.

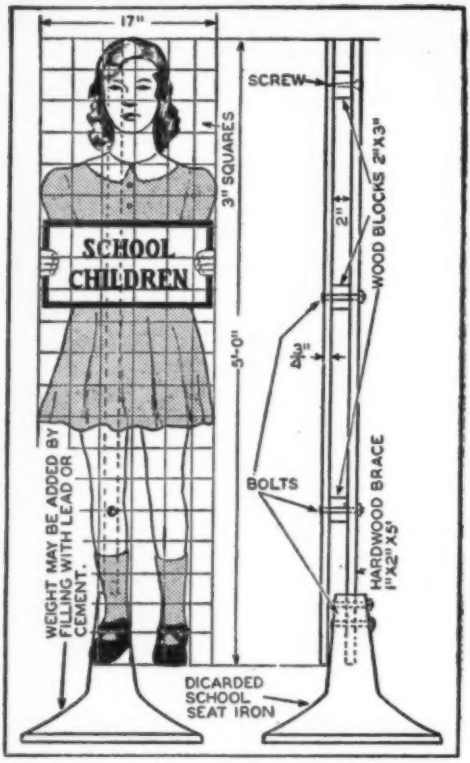
MI SHOP SCRAPBOOK INFORMATION SHEET

Combination Woodworking Machine

THIS introduces a new series of information sheets, on Machine Tools, which should be welcome additions to your shop data. Familiarity with various types of wood and metal-working machinery is, of course, desirable, even if one's knowledge is necessarily limited to identification of the type and functional parts of such equipment. As machine tools merely perform, in the majority of cases, the usual hand-operations of cutting, planing, shaping, etc., these sheets will provide clear illustrations to convey the range of operations for which each piece of equipment is designed.

A well-equipped woodworking shop might contain a half-dozen or all of the following machines: a band-saw, a circular saw, a jig-saw, a jointer, a mortiser, a shaper, a sander, a trimmer, a lathe, a planer. (Details of each of these will follow in future issues.) To find all of these in a home-workshop is not to be usually expected. However, the Combination Machine shown here is no stranger in the home-workshop. It is a universal machine which consists of a small lathe as the basic tool to which attachments are added for boring, grinding, sawing, buffing, jig-sawing, etc. The various parts and their function are clearly indicated.





School Safety Doll Cutout

MOTORISTS quickly slow down as they approach life-size and life-like "Safety Doll" cutouts flashing a warning to them from the side of the school road. These animated cutouts make interesting and useful projects for the school shop or woodworking room. Very little artistic ability is required to sketch out a full sized figure, using a classmate or picture to go by, on a board approximately 60"x14"x¾". After cutting out the figure on a bandsaw or jig saw, a hardwood support 2"x1"x5' is fastened with bolts and three blocks of wood 3"x3"x1½" to the back of the doll. (See drawing.)

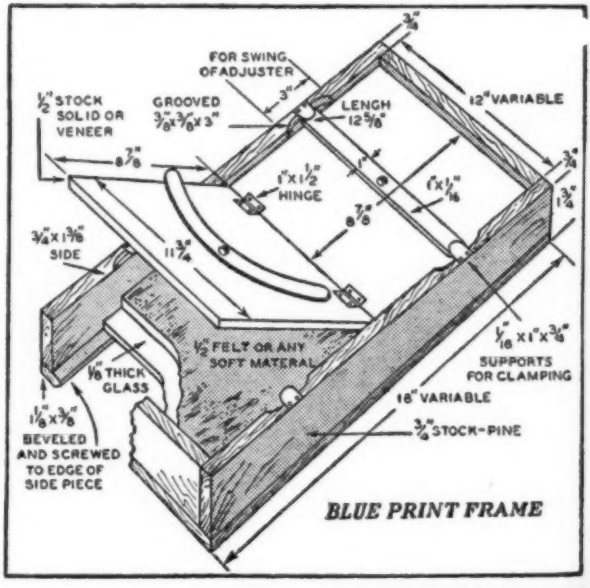
Old discarded school chair irons make excellent bases for the "Safety Dolls" and are easily attached. Lead or cement may be used to fill the inside of the hollow irons to give them added weight. After sanding thoroughly, sketch in the face, clothing and a suitable sign, as indicated, and paint on bright colors.—*Roger Woodbury*, Woodworking Instructor, Lynnfield Center School, Lynnfield Center, Mass.

Frame For Shop Blueprinting

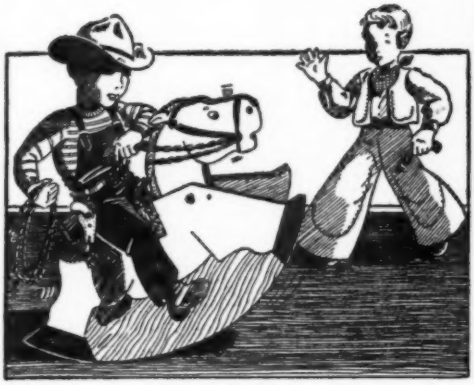
SHOP teachers make use of many different methods of producing their own blueprints. The blueprint frame shown below is about as simple an arrangement as can be devised. It is easy to construct, light in handling, and may be stored away in small space when not in use. Needless to say, shop students and home workshop devotees will find this frame the handiest possible device for performing the exposure stage necessary in blueprint making.

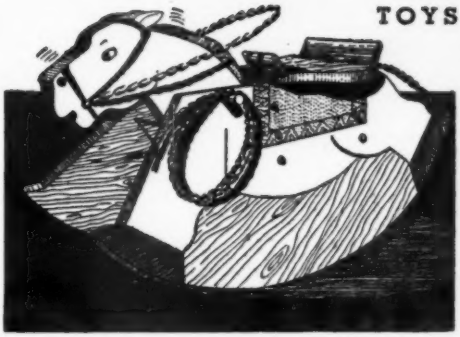
Since the measurements shown in the illustration are for convenient size and as construction details are self-explanatory we may go on to a few specific details in addition to reviewing the blueprinting process. Plain window glass, for example, is adequate and should, of course, fit the frame snugly. The felt, preferably ½" thick, should be ripple-free to prevent waveline reproduction of tracings. Where difficulty may be experienced in obtaining spring steel for the clamps, wood clamps may be used, providing attention is given to securing a good fit.

With the blueprint frame ready for use, the printing procedure is as follows: place the face side of the tracing to be reproduced next to the glass inside the frame. Center the blueprint paper on the tracing; then adjust the felt over both to hold both papers in place. [*Continued on page* 152]



BUCKING BRONC



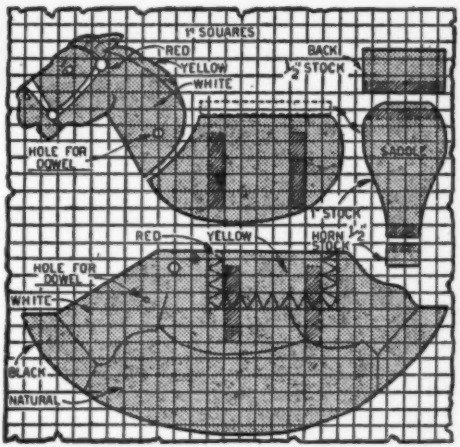


Any lively youngster up to the age of 5 will be more than pleased with this bucking, rocking mustang. It's easily made, and any male parent who's handy with tools can build one.

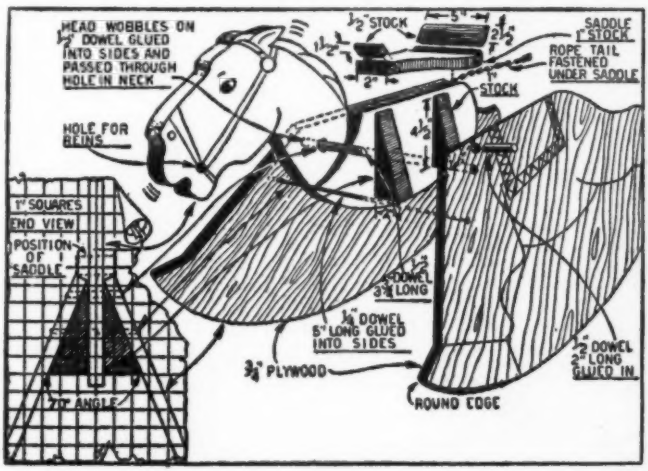
by R. L. Fairall

A WESTERN style rocking horse will delight that young cowboy. This bronco has a western saddle, rope reins and tail and a handy dowel on which to hang a lariat. The head moves slightly to give added motion.

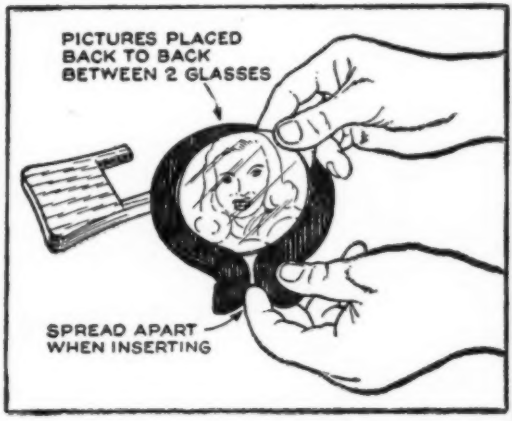
The two side sections, the body and head are traced to ¾" plywood and sawed out. Two triangular sections of 1" stock are then nailed to each side of the body and the sides screwed to these sections. A ½" hole is drilled through the neck, as indicated, and a ½" dowel inserted through and glued into the sides acts as an axle on which the head wobbles. A ¼" dowel in front of the neck and glued into the sides keeps the head from tipping back too far. Next the saddle is cut from 1" stock, a groove made in the front and back, and the horn and back (½" stock) glued in. A rope tail is tacked to the body section; then the saddle screwed down over it. The rope reins are tied through a ½" hole in the head, and a ½" dowel glued into the left side section to hold a length of rope or lariat. Round the rockers, and make sure the dowel in front of the neck is close enough so the neck does not swing back and hit the saddle. Paint house and equipment as indicated in drawing.



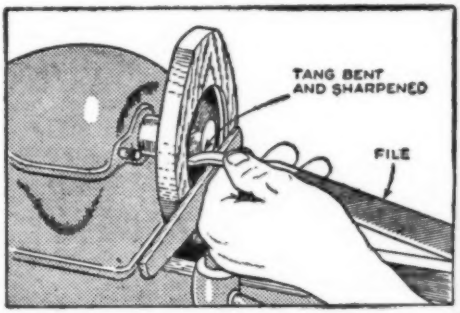
Above are patterns for the different parts of the pony, while assembly details in perspective are shown below. Construction is similar to that of a saw horse, and has same rugged strength.

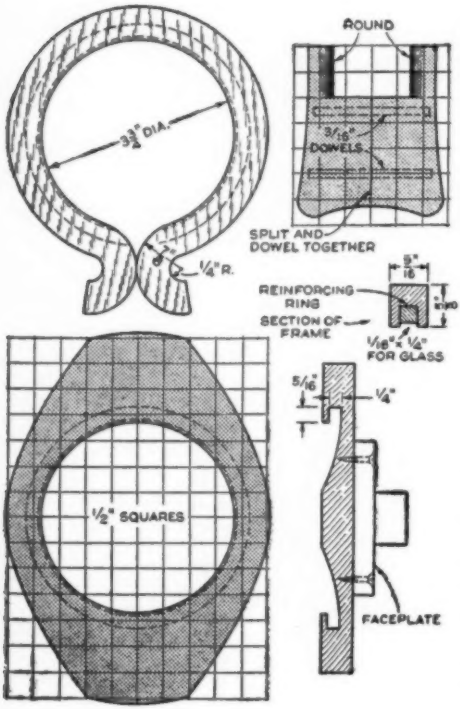


TWO-FACED PICTURE FRAME



Above: Finished frame. There's a picture on the other side, too. Open end of frame is spread slightly with the finger, for inserting double glass with pictures sandwiched between. *Right:* Turning out the groove for the reinforcing ring with a special tool made from file. Drawing below shows details.

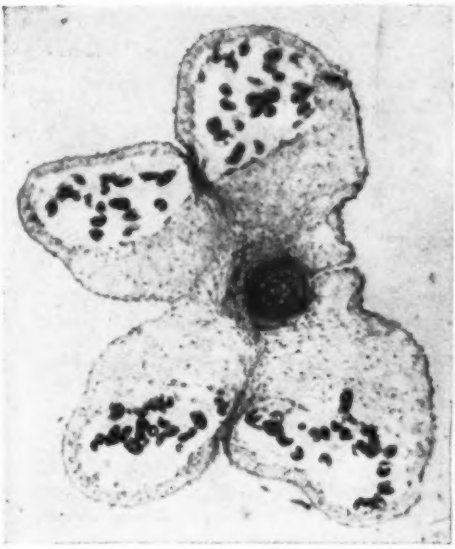


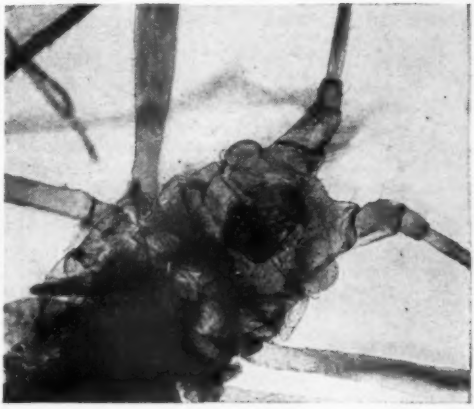


BOTH sides of this attractive and cleverly designed picture frame will display your favorite portraits. It will show up to best advantage if placed on a table or cabinet which is well away from the wall.

The inside of the frame is turned and the outside is bandsawed. First, mount an oblong piece of $\frac{5}{8}$" walnut on the faceplate of the lathe and turn a groove as indicated in drawings. From another piece turn a ring to fit the groove. This is a reinforcing ring which is glued in with grain running opposite. When the glue is dry, remount on the faceplate and complete inside turning of the groove which holds the glass. True face and back to a thickness of $\frac{9}{16}$". The bandsaw or jigsaw is used to trim off the outside, cutting the feet at the same time. Cut the clip-base from $\frac{5}{8}$" stock, shaping roughly square and oversize, then split as shown in drawing. Dowel the two parts back [*Continued on page* 166]

BLOW UP YOUR GARDEN
—TO 200 DIAMETERS





Above: This is a plant louse as it appears "blown up" 100 diameters. The eyes look like golf balls. *Left:* Not a butterfly, but a cross section of the anther of a flower, showing the pollen grains. *Below:* Bureau of Plant Industry, U. S. Department of Agriculture uses this microscope in studying eel-like nematodes.

by Walter E. Burton

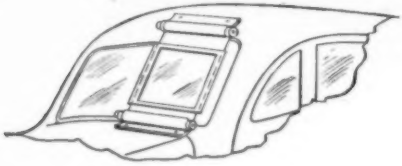
HAVE you an art-glass factory in your back yard? If so, you probably call it a lily pool. From its slimy depths you can dredge marvelous examples of a tiny glass worker's art, minute crystalline jewels whose delicate beauty would be difficult to duplicate even by a Cellini. These are the silica skeletons of diatoms, tiny one-celled plants invisible to the unaided eye. They represent but one of the thousands of wonders present in every garden, but of which the average gardener is totally unaware because he cannot see them as easily as he can see a red water lily blossom. What he needs is a microscope to "blow up" the specimens.

The lily pool is a good starting point for a microscope journey through a garden. Scoop a little muck from the bottom, spread some of it in a drop or two of water on a glass slide, lay a clean cover glass over it, and focus your microscope, at 100 to 200 diameters magnification, on the layer of debris. Nobody can predict with certainty just what you will see. Probably there will be strange, tiny creatures darting swiftly or sailing lazily across the field of view. One-celled denizens of the backyard deep, they include such organisms as the paramecium, euglena, and amoeba. Looming among them may be a many-celled creature or two, such as the rotifer and hydra. For detailed information about the legion of minute monsters, consult a good biology textbook.

Here's something worth a second glance. Long, slender, and embellished with fine lines that make a delicate, lacy pattern, it shines like a crystalline [*Continued on next page*]

New Products And Inventions

[*Continued from page 11*]

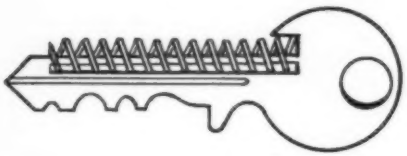


mounted on the front of an automobile so as to supply clean section of film on the outer part of a windshield. Movement of the film is effected by a crank lever inside the car. The film is preferably water-proof, such as moisture-proof Cellophane. If desired, a colored film can be used to reduce sun glare. Excellent protection against sleet and snow is said to be provided by the novel invention. (No. 2,271,099.)

* * *

Instead of using the index finger as the trigger finger, a recent patent suggests the use of that finger as a sighting help; while the middle finger becomes the trigger finger. This invention modifies the usual revolver or rifle by providing a groove along one side of the firearm, the groove being shaped to accommodate the index finger. For right handed marksmen, the groove is on the right side of the barrel; while for left handed marksmen, the groove is on the left side. The groove requires that the cartridge chamber be placed off center with respect to the barrel. The innovation provides more accurate sighting and a firmer grip of the firearm. (No. 2,270,707.)

* * *



No more keys forgotten in locks, if a newly patented self-ejecting key meets expectations. The unique key is provided with a spring which compresses when the key is inserted into the lock. The key is automatically ejected from the lock when it reaches either the locked or unlocked position, as may be desired. The key should be

[*Continued on opposite page*]

Blow Up Your Garden

[*Continued from preceding page*]

brooch. And here's another, not quite the same shape, but similar, and yellowish-green inside. These are diatoms, the art-glass products of the pool. The ones containing the color are living organisms, those lacking color are merely the silica skeletons of once-living plants. Such skeletons may endure for millions of years. Some of the silver polishes used by jewelers and housewives consist mostly of ancient diatom skeletons. Living diatoms, although plants, may be seen swimming across the microscope field, for they possess the power of locomotion.

Back in the garden, you capture a honeybee, one of the most interesting insects, from the microscopist's standpoint, to be found there. Maybe the bee stings you. If so, it probably is done for. She (yes, it's the "lady" who does the stinging) will no doubt lose her stinger because it sticks firmly in your flesh. When you pull the bee away the stinger, together with sundry poison sacs and ducts, will remain. The bee will soon die, so you might as well dunk it immediately into a phial of rubbing alcohol. With tweezers extract the sting from your skin and put it on a slide. Add a little water and a cover glass. The microscope shows the stinging equipment to be a highly-organized machine, including a pair of barbed, needle-like lances, a chitinous sheath to keep them in, and a system of poison sacs and ducts to feed irritating fluid to the wound made by the lances.

Although practically every part of a honeybee is interesting through the microscope, the legs are particularly so because they form a kit of useful tools. There are fine-toothed combs so Miss Bee can remove pollen grains from the hairs covering her head and compound eyes; and on the first pair of legs are curved, toothed recesses for cleaning the antennae. Some of the legs are provided with pollen baskets, concave and surrounded by spines or hairs to hold the pollen cargo in position. There are spurs at the joints of the middle pair of legs for prying purposes. The bee's knees on the third pair of legs from the front form powerful, spiny-jawed pincers used in working beeswax.

Do you remember how bowmen such as Robin Hood liked to make their bows of yew wood? Your garden doubtless has a few examples of the yew, although you may know them only as Taxus. Down in the heart of Taxus you will find something of romantic interest. Break off a branch and slice it lengthwise with a razor blade to make very thin shavings. Focus your microscope on one of these shavings, so you can see the cells clearly. Now can you guess why yew bows were so popular? Each of the cells looks something like a tiny coil spring. It is reasonable to believe that all the cells, working together, function like so many coil springs acting in unison to send an arrow on its way. Who said the

[*Continued on opposite page*]

Blow Up Your Garden

[*Continued from preceding page*]

innerspring mattress was a modern idea?

Mosquitoes, dunked in alcohol to kill them, make attractive subjects. The proboscis of the female, like the legs of a honeybee, is a veritable kit of tools—but designed for the unpleasant business of skin-puncturing. The hairy antennae flanking the proboscis are equally interesting, as are the compound eyes, scale-covered wings, legs, and body hairs. The plume-like antennae of the male are particularly beautiful.

Slice any plant stem crosswise with your razor, to make very thin sections, and you have some of the most beautiful objects for microscopic study to be found anywhere in the garden. Place the slices in water under a cover glass, for observation at 20 diameters and up. You can increase the beauty of the cell patterns by applying staining materials such as mercurochrome, iodine, or special biological stains.

In your exploration of stems and other parts of plants, and in studying pond water, you may come upon tiny, eel-like creatures that thrash about like vinegar worms. These are nematodes, of which there are untold millions in even the tiniest garden. Nematology is a huge subject in itself, and one of such economic importance that Uncle Sam has a laboratory devoted entirely to the study of nematodes that infest plants and animals.

There is a world of hidden beauty in each garden blossom. One way to uncover it is to slice a flower into thin sections. Cross sections of flower stamens, ovaries, and other parts make beautiful objects, but sometimes special technique is required to bring out the details satisfactorily by staining, etc. Pollen grains are easy to collect. Touch a glass slide against a flower, or hold the blossom above the glass and shake it. You can observe the pollen dry or in water. Place some of the grains for a few days in sugar water, and you may be able to see it germinate, like tiny seeds.

Gardening with the microscope can be a year-'round hobby, for in winter you can work on house plants and a balanced aquarium. And don't worry about running out of fascinating things to look at, for they are practically inexhaustible.

THE JAPS SAY . . .

***"We must pursue a policy of blood and iron!"*—Baron Giichi Tanaka, former Japanese Premier.**

AMERICANS SAY . . .

. . . our policy will be more and more War Bonds and Stamps, to guarantee that it will be Jap blood that gets spilled!

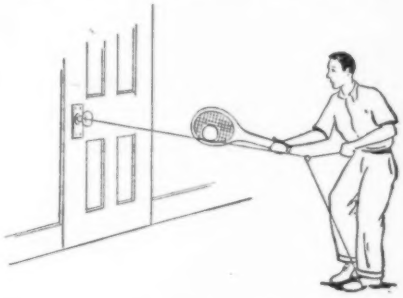
New Products And Inventions

[*Continued from preceding page*]

particularly useful to motorists who forget to remove ignition keys. (No. 2,271,048.)

* * *

Other interesting patents include a heater for golf balls, heat being furnished by the reaction of chemicals with water. The heated balls are stated to give from 20 to 25 additional yards of flight. (No. 2,272,340). . . . A sterilizer for treating furrows of soil with superheated steam. (No. 2,272,190.) . . . And a tennis practice device comprising a tennis ball attached at one side by a



rubber band to a fixed support, such as a door handle, and at the other side by two flexible bands, one of which is held by the hand, while the other is engaged by a foot. Proper foot position and stroking is taught by the device. (No. 2,270,957.)

Ant poison can be set out easily and safely with this device for which a patent was recently applied. It consists of a metal bracket bent to hold an ordinary crimped bottle cap, and has two sharp prongs which may be forced into the trunk of a tree or fence post or window sill. Any ant poison of syrup type may be placed in the bottle cap "container" as a fatal lure for the insects.

Summer comfort may be achieved by the use of a newly patented ventilated pair of trousers. The legs of the new garment are provided with slide fasteners attached to slits in the legs. The slit is made preferably at the inner seam and extends to a point well above the knee. During hot weather the fastener can be moved so as to open the leg of the trousers or both legs to permit free access of air. By means of a suitable snap fastener the cuff of the trouser leg can be attached to the side to prevent the end of the leg from touching the ground when the wearer is sitting down or kneeling.

Truth About The Sea Otter

[*Continued from page 53*]

the tank in order to load the cargo, and then they were to be welded back in place again. We could have loaded, for instance, airplane parts and then filled in the remaining space with grain. Or the boat could have been used as a tanker. One of the principal virtues of the *Otter* was to have been the fact that it would not necessarily have been treated as a traditional merchant ship.

Anyone who cares to do so may consult the records of the Patent Office to see the *Otter* in all its original unadorned and plain detail. The whole story of it is to be found in the correspondence files of the White House. President Roosevelt knows all about it.

As a matter of record, my plans were filed with the Patent Office on April 15, 1941. Later they were assigned by me to Roland L. Redmond of New York City. Mr. Redmond is married to a first cousin of President Roosevelt.

At this point the *Sea Otter* began to get what football players call the razzle-dazzle. Politics, profits, labor angles and bureaucratic finagling began to get mixed up in the design. Innumerable persons began to see an opportunity in the *Otter* to make a profit, to extend their power, or to promote their personal interests.

To cite a specific example of how the *Sea Otter* grew out of hand: Originally, the boat was to be manned by a crew of nine. There were to be no sumptuous quarters. There was to be only sleeping space. But as the design grew, the crew number was raised to fourteen—and then to twenty-three! And later, by British suggestions, it was to be put under standard voyage rules!

To the simple tower quarters of the crew were added, first, a captain's cabin, then toilets, then a mess hall, then any number of other refinements found only on a luxury liner.

See how the floating junkpile had blossomed forth!

In the original design, the *Otter* had a draft of eleven feet. There were four wells in the boat so the power plants could be changed in transit and drawn up into the hull when the ship was taken over by the tugs. A second patent provided for reduction of draft with the propellers working. The use of the deep propeller position, 17 feet, which has been criticized, gave the most efficient propulsion yet achieved with screw propellers. Only at voyage end was there the inconvenience of having to use dockage planned for normal ships.

But to go back to the beginning: First of all, an appropriation of $15,000 was allocated for purposes of investigation. I agreed to take a personal service contract to assist in the birth of the *Otter*. Next a firm known as Weaver Associates, with offices on DuPont Circle, Washington, of which W. Starling Burgess, prominent yacht designer, is a member was retained. Mr. Burgess is known principally for having designed the *Enterprise* and the *Ranger*, millionaire defenders of the American Cup. Unkind pesons in unofficial circles commented on the fact that a yacht designer was being given the task of designing the hull of a floating junkpile. At any rate, the *Otter* began to collect people and uncollated firms as honey collects flies.

The drums were still beating, however, when the Navy Department began to cool on the idea—for reasons never officially explained. Navy funds froze.

There were, however, private citizens who still saw possibilities in the design. Private money appeared—enough to build an 80-foot model of the *Otter* in Long Island sound. This model was built much against my will. It was inspired by the idea a working demonstration was necessary to convince officialdom of self-evident facts. Neither

In next month's MI—

Capt. Borden poses in the MI studios with a Jap machine-gun wrecked and found at Pearl Harbor December 7—the only one in the U. S.!

"I DISCOVERED SECRETS OF JAP WARFARE"

By Capt. Charles Borden

Jap bombers hurtling over Pacific wastes toward the treachery of Pearl Harbor December 7, passed above a tiny sloop taking this South Pacific adventurer and his wife back to Hawaii and the States. The bomber that dipped from formation, ascertained that the Bordens had no wireless, then winged on contemptuously, would undoubtedly have machine-gunned the couple as it was to kill others at Honolulu a few hours later if its pilot had suspected the 16-foot boat was carrying secrets of the Nipponese and their stab-in-the-back warfare. Once in the U. S., intrepid Captain Borden brought them at once to MECHANIX ILLUSTRATED in an exclusive, breath-taking story that will apoear in the August issue. Don't miss it!

the hull power plants or projected methods of fabrication were used in its construction.

The model was constructed, however. Its performance was excellent. Again the Navy Department became interested, and government money once more became available, this time enough to build a full-scale *Otter* for sea testing purposes.

This version of the *Otter* was built at a Gulf port and later it went to Charleston for official Navy tests. Any number of criticisms have appeared in the press as a result of the publicity attending these tests.

May I say that, although the official reports were never made public, I, myself, know what was in the original report and I know, also, that much of the material which has been published since has not been correct.

Here are the principal criticisms of the *Otter* as published in the press:

1. *The "Sea Otter" rolled as much as 38 degrees in a high wind.* This may or may not be correct, although it is contrary to the information I have. But if it is correct, it occurred while the boat was being turned against a high sea, and any other ship of her size would have done the same.

2. *She could not run astern.* This is absolutely correct—and for an amazing reason which is another commentary on what happened to the *Otter* in the course of her design. Originally, under my plan, the *Otter* was to have been built with sixteen automobile motors having a *single* set of transmission gears for each bank of four motors. As built, she had *sixteen* sets of transmission gears—including sixteen reverse gears! When the backing test was made, only a few of them reversed!

3. *That, though she made 10.6 knots with a load of 1,300 tons, a conventional Maritime Liberty Ship made 9.75 knots on the same power carrying seven times as much cargo.* This charge was utter bunk. The basis for it was arrived at by rating the *Otter* at 1,760 horsepower, whereas she actually turned up 630 horsepower! Actually, the *Otter* could carry a load per rated horsepower comparing favorably with any standard merchant ship—even though such was not the original purpose of the boat. For her designed purpose of carrying large light assemblies such as aircraft fuselages, etc., with grain as ballast, she could beat the average ship. If you take a 20-foot slice out of a hull to contain everything necessary to operate the ship, all the rest is available for cargo. The *Otter* as built had an arbitrary length. It could have been increased 33⅓% without calling for more power plant.

4. *She uses narrow strip-mill steel, now essential to the war effort.* She was *originally* designed to use strip steel and to be machine-welded. The machine-welding plan was abandoned entirely through ignorance of such methods. The actual ship was built of *steel plate.* The statement that steel strip is being adapted is still moonshine. This is a good example of the extreme confusion which exists in the public mind concerning the *Otter.*

5. *After some 150 hours' use, her 16 gasoline motors began to show signs of deterioration.* So what? As a normal thing 150 hours will cross the Atlantic on the northern route. If it will not, spare motors will take care of the trouble. BUT the principal trouble with the engines used in the test trials of the *Otter* was that the engines were wrongly used and, more important, the wrong kind of transmission was used.

Had the original plans been adhered to—they included a centralized transmission and properly synchronized motors so that all did their share of the work—I am confident that no such trouble would have arisen.

6. *The cargo capacity of the ship was too small to justify the expense.* This is the most utterly nonsensical criticism of all. In the first place, without considering the merits of the statement, the *Otter* was originally conceived to deliver *herself,* a pile of scrap and sixteen needed automobile engines, to England, plus whatever extra cargo she could carry. As a matter of cold fact, the *Otter* could be produced at a cost of about $100 per ton, which is very low in ship building. (Actual weight of the ship was about 400

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"If any of the guests should say 'It's the spitting image of George'—you squeeze the bulb like this!"

Frame For Shop Blueprinting

[*Continued from page* 144]

Now insert the hinged cover into the frame, clamping down one half-section at a time. The whole assembly is now ready for exposure to sunlight. One precaution should be mentioned here. This entire operation, up to this point, must be made in a darkened corner so as to avoid spoiling the paper.

Also, before proceeding with the next step, prepare a solution of potassium bichromate in any convenient flat receptacle for soaking the blueprint sheets after exposure. Similarly, provide yourself with another flat container filled with plain water. After the sheets have been soaked in both liquids, it will be necessary to put them up to dry. Sometimes a line is strung across the room for this purpose. The sheets may be pinned up at one edge. Of course, an extra margin of waste should be provided for this purpose.

With all in readiness, you are now prepared for the critical operation. Bring the frame over to a window and hold it up with the glass side showing the tracing to the sunlight. Expose in this manner for about one and one-half minutes. Then remove the paper and let it soak in plain water for about 3 minutes. While one sheet is soaking, you may go on to the next exposure for another sheet, continuing the process. The first paper is now ready for the bichromate solution; allow it to soak tracing side face-down, for another 3 minutes, after which place it back in the plain water bath for a full five minutes. Then hang up to dry.

This is all that is required for producing any quantity of clear, attractive blueprints in which both drawings and text matter will be easily legible. To preserve the blueprints while creating neat appearance it is recommended that the blueprints be pasted to individual sheets of cardboard.

"Just out of curiosity, Mr. Jacobs, how did this speedometer ever get stuck at 90 miles per hour?"

Truth About The Sea Otter

[*Continued from page* 151]

tons.) The chief trouble with the administration of the *Sea Otter* was that no one connected with it had any knowledge of mass production methods, or of orderly engineering.

I have nothing to gain by adoption of the *Sea Otter*. I have put myself out on a limb by criticizing the management of the boat, as above. I am an engineer.

Except that we now have a war in the Pacific It is obvious to me that the *Sea Otter*, with some considered changes and competent planning, could be of tremendous value to America in the Pacific war *as a nomad tanker*. The *Otter* could be produced in innumerable inland factories, without highly specialized shipyard equipment, at the rate of many a day and at a cost of $100 a ton. An *Otter* could spend months in the Pacific carrying her own fuel, to rendezvous with warships and refuel them. At her price, we could afford to refuel a warship with her, salvage the power plants, and then *sink* the *Otter*—and still be money ahead.

The point I am making is that the *Sea Otter* has any number of possibilities for America. As she is now being produced, it appears that she will become just another tramp merchantman with few of the original *Otter's* unique features I want to see the bureaus and the Navy Department forget about the mess the *Otter* has become and go back to her original idea. As I have said I do not stand to profit by such action.

Whatever credit may accrue to me as the originator of the idea is unimportant in the long view of the value of this boat to our country. I believe that America needs the *Otter*. I plead tha she be given a fair trial.

Steel Wool As Camouflage

An English contribution to the art of war that makes use of three highly domestic articles is represented by patent 2,278,898, issued to C. S. Schofield of London. Mr. Schofield's invention would make the camoufleur's job easier by giving him the chicken-wire netting, which is already his foundation material, ready covered with steel wool held on with paper clips.

Unprotected steel wool would quickly rust to uselessness, the inventor explains, but he proposes to protect it with a coating of an insoluble phosphate, by the process known as Parkerizing. Thus protected, it can be sprayed with paint to give it any color desired, for instance green to imitate grass.

In some National Parks, ranger naturalists lead camera trips, guiding picture fans to good shooting spots.

Bug Radio

[*Continued from page* 73]

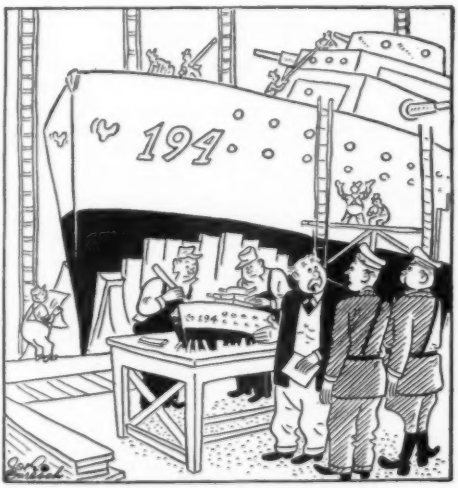
nose of almost incredible sharpness in perception, but its power would not bring a dog much food or companionship if faced with the demands made on the insects' antennae. In a period of time far briefer than that animals need in locating food, swarms of wasps appear in search of sweet stuffs like molasses, and flies find rich, or evil-smelling, matter.

But the really remarkable evidence of insect antennae's sensitivity is found in the way they bring male and female together quickly and directly. The pre-mating interval is chiefly a male's active search for the female, mainly because the female is less capable of flying and must wait until a suitor finds his way to her.

Not that this is a long search! The male of a night moth covers a couple miles in order to reach a female just emerging from its cocoon. In the case of one night peacock's-eye moth marriage, 127 males appeared within six and a half hours to claim the female as bride. In another example, several males came to the window of a completely enclosed room in which a female of the oak silkworm moth had just emerged from its cocoon. Suddenly, some of the males were in the room—they had come down the chimney!

A butterfly collector on an outing carried in his knapsack a female of the angular spotted moth which he had caught and killed just after it was out of its cocoon. He was surrounded on his way home by swarms of males, and the box in which the dead female had been kept was assailed by males long after the creature had been removed.

Numerous more examples of the power of the antennae in making the male insects aware of the location of a female have been provided by naturalists. The greater demands of the male antennae are consistent with their far stronger and more complex construction. All, however, are impressively intricate. Each insect feeler is penetrated with olfactory nerves which terminate on the surface of the feeler at so-called olfactory cells in the form of small bars, cavities, or balls. In the case of many insects, only a few of these cells are to be found on each of the feelers, while in the case of the bee each feeler has about 15,000 olfactory cavities and 200 olfactory balls! Since "living aerials" of this sort are the seat of the insect's organs of sense, it is little wonder they can locate sources of food, and mates, so easily.



"We always make a duplicate for our files!"

Tourist Deep-Sea Diving

[*Continued from page* 61]

shore via a short gangway, is lowered to the observation floor by an electric elevator down the core of the bell.

How would you like to join a group just getting sealed up for a trip into the water's depths? You would?—all right:

All aboard! Bells gong the cast off signal. The hatch is swung down and screwed tight, sealing the tiny universe from the outside world. Oxygen hisses from the air-supply drums. Electric motors start humming and the winch grinds in cable, breaking the s i l e n c e of the thrill-bound passengers.

Water closes over the conning tower as the winch reels in the thick steel cable, moored to a boulder, by which the bell is towed under. As the bell sinks, it seems that the sheer, jagged precipice is moving, passing upward along the portholes. The descent ends unnoticeably—the mass of steel quietly comes to rest on the huge boulder on the bottom.

The clear water enables you to see nearly a quarter mile. Beyond the fish curiously poking their snouts against the portholes, the cavernous mouth of the subterranean river below Silver Springs can be seen in partial silhouette. Down there the vegetation grows tall and the underwater grass and flowers bend and sway in submission to the river current. Plying along the surface 55 feet above, the bottoms of boats look like weird monsters. Undisturbed, the surface appears like a giant mirror in the glare of the sun.

Four bells sound, the signal to ascend. No motive power is necessary to lift the bell, it soars upward as the cable runs out. The brake released, gears grind and a lifting sensation like that in an elevator is felt. As the bell nears the surface, the operators gaily unleash the winch and let the bell crash through the surface into the air. Then it drops with a thrilling jar to normal displacement, bobbing like a cork on the disturbance it created. Your unique dive is over!

Build A Model Submarine

[*Continued from page 124*]

vane ends through the rudder opening. The plan and drawing will give you a clear picture of how it looks.

Above each propeller is a guard, made of bamboo 1/32" square, about 2¾" long. Bend to shape and insert into holes drilled into the hull at the places indicated on the plan. The braces, six of them, three on each side, are also 1/32" square bamboo, put on as shown. Sand these pieces round before fitting.

Just above and to the rear of the guards are the rudder control arms. They, too, are made of bamboo 1/32" square, inserted into holes drilled in the hull, and glued to small triangular pieces of pine fastened on either side of the rudder. This about finishes the hull. It may now be painted.

A good paint should be used. And at least three coats applied. Fine sandpaper should be used between coats. All U. S. Submarines are painted a dull black. (The model was painted gray with a red waterline strip and black bottom for the sake of the photos.) Of course yours may be finished the same way, if you so desire.

The number and details were put on with ink, and the scupper holes, from blacked gummed paper, punched out with an ordinary ⅛" dia. paper punch, and glued to the hull. The four steps on the side of the hull were bent from No. 28 wire and inserted into pin holes made in the hull. The anchors are the stockless type, and should be bought. Clip off the tops until they fit into the ports.

The next job is the conning tower and fittings. It's best to make the tower first. A pine block 1-9/16"x1-1/16"x3⅝" will do. Shape it as shown. Remember that the bottom should fit the curve of the deck. When you have finished cutting it out, add the cardboard top sides, as shown, as well as the doors and portholes in the foward part, ⅛" dia. holes drilled 1/16" deep. Add the deck gratings, made of the same material as you used on the main deck.

The hatch atop the tower and the loop antenna which goes on the aft part is clearly shown on the plan, and should be added when the grating has dried. The hand grabs, eight of them, four to each side are put on next, No. 28 wire bent to shape.

On each side you will notice there is a bracket, a Vee frame, and an insulator, which holds the foward antenna.

The bracket is a pin filed flat, bent to shape and glued to the sides of the tower. Just below it, the Vee, either 1/32" dia. bamboo or wire, is made and inserted in holes, then glued securely. A small bead with a pin, whose head has been clipped off is run through it and into the side, finishing the lead in.

On top of the tower is a hand rail, No. 28 wire. The seven posts may be made by twisting the wire around and over the end of a pin to make the loops. Insert them into holes drilled into the tower 1/16" deep. The posts are ½" long, from the deck to their top. The plan will give you their spacing.

The running lights are made from ⅛" diameter cardboard disks cut in half, and a red, green and white bead glued between them. These running lights are glued right behind the antenna brackets and at the rear of the tower. The green goes on the starboard, or right, side. Be careful you don't paint over them later on. Obtain the rest of the detail from the plans.

On top the tower, the periscope housing is placed. Cut it from a pine piece 2⅛"x¼"x⅝" and carefully round it to a streamline shape.

Drill the holes to take the main antenna spreader and the lead in. The drawings will give you the detail. They are made from pins with their head and ends clipped off.

Periscope housing is glued and pin-pegged in place. The whole thing is painted, the bell added, and it is pin-pegged and glued to the hull. Make certain that it is in the exact position, and is centered.

The fittings are made now. Make those foward first. Naturally, then we start with the bow post and light. The post or staff is 1/16" dowel with headless pins as braces. It is topped by two white beads.

All hatches are made up of disks of cardboard, glued one on top of the other. Their sizes will be found on the plans. The chocks, 10 of them, should be bought and are 5/16" long.

Make two capstans, one for the forward deck and one aft. They are built up of cardboard disks, and short lengths of ⅛" diameter dowel, as shown.

The torpedo hoist and hatch are built up of dowel, cardboard pulleys and a flat piece of scored wood for the hatch itself. Too much description will tend to complicate this construction rather than simplify it. So it is suggested you work directly from the plans and drawings.

The loops that hold the hoist lines and the hand rail around the hoist are bent from No. 28 wire and inserted into the deck. The size and shape will be found in the plans. Note that the hand rail going around the gun is made the same way as that around the hoist, only the measurements differing.

Following the torpedo hoist is a bit and chock. Just forward of the conning tower is a pump-like fitting. This is made from a ⅛" dowel, with a cardboard "C". Two pins run from the bottom of the "C" into the top of the ⅜" length of dowel. Build up as shown.

Aft of the conning tower is the gun. You may make it from a dowel, ⅛" tapered and fastened to

[*Continued on page 156*]

Coming: Universal Focus

[*Continued from page 94*]

subject matter to be sharply focused. Thus, by some method of control to be developed later, actual focusing will be done within the lens itself —over a space of 3/10ths of a millimeter!

With infinite depth of field a reality, the camera of the future will be able to shoot with a wide-open lens and still get sharpness over its entire range of view, thereby making possible sharp pictures, taken at comparatively fast shutter speeds, under poor light condition! The lens diaphragm will be used merely to prevent over-exposure by controlling the amount of light entering the lens. It can also be used to increase the depth of field in the foreground for bringing subjects closer than 4 feet from the camera, into sharper focus.

The new lenses, when adapted to still cameras, will be a boon to color photographers, who at present have to work with a terrific amount of light in order to permit them to stop down for depth of field. The oscillating lenses, which are fully color corrected, can be used wide open and still get that remarkable sharpness throughout!

News photographers will no longer require that "mathematical eye" for guessing distances accurately. They'll be able to just raise their cameras and shoot, confident that whatever they aimed at will be sharply rendered, regardless of its distance from the camera! The lens will permit shutter speeds up to 1/250 second, and pictures taken through it will be rendered in true perspective. The foreshortening distortion commonly encountered when shooting extreme closeups with an ordinary short focus lens is eliminated.

Its value to photomicrography, in which depth of field is now measured in fractions of a millimeter, has yet to be exploited, as well as its effectiveness on swing back and tilting lens cameras, but the results promise to be astounding.

The Electroplane camera even promises to revolutionize television with its unique characteristics! Many authorities believe that it should definitely solve television's critical needs for obtaining sharp focus and depth of field simply.

The cost of this oscillating lens, when it has been perfected for still camera use and put into production, will be well within the means of the average advanced amateur, probably not exceeding $100. It may be designed to fit on an auxiliary lens board for adaptation to standard cameras, or an entire camera may be designed around it.

The Smith-Dieterich Corporation further states that oscillating lenses of longer focal lengths can be computed to speeds of f/3.5 or even f/2; it will be working on these computations, preparing for the time when priorities will no longer prevent it from producing the finished product and presenting it to an anxiously waiting public.

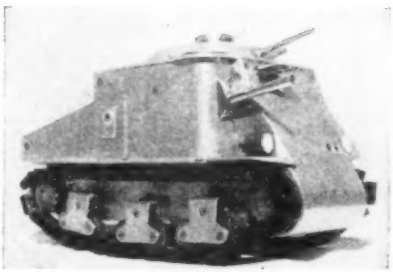
Under The Mid-Day Sun

[*Continued from page 97*]

if you decide on a slight up-angle shot. Of course, if you figure on a sky background, a filter is a must for the sake of good contrast between flesh tones and the sky.

If the greater portion of the face is in deep shadow, remember to expose for the shadows and let the highlights take care of themselves. Otherwise, take an "average" meter reading. The accompanying illustrations, all of which were taken between noon and 12:30 p.m. of a fall day, show the many interesting effects that can be obtained under mid-day sun by varying the position of the subject. Contrast the back and side-lighting achieved, with the straight shot taken head-on at high noon.

MODEL BUILDER'S DREAM!



Next month's issue of MECHANIX ILLUSTRATED will carry plans and instructions for building a model that is the materialization of a model builder's dream. Imagine a miniature M-3 Army tank rumbling across the floor, spitting tiny shells from its scaled-down 75 mm. cannon, smashing through obstacles placed in its path, and executing complicated maneuvers at the whim of its master's hand on the remote control box! If you can't imagine it, look at the accompanying photograph and see the grim realism of this model marvel. And believe it or not, the MI Baby M-3 Tank is so simple and inexpensive to build that even a relatively inexperienced modeler can make a good job of it. Don't miss it. Reserve your August copy of MI *now!*

A Torpedo-Destroying Gun

[*Continued from page 45*]

torpedo's war head should either explode the torpedo or so damage its mechanism as to render it harmless, according to a number of experts whom MECHANIX ILLUSTRATED has consulted.

There has been much mystery in the public prints about torpedoes. Actually, these tin fish of death are marvellous machines of destruction; but their operation is quite easily understood.

Torpedoes used by both Axis and United Nations navies are pretty much the same. The submarine torpedo is generally 24 feet in length and is divided into four main sections: 1. The warhead, which contains between 500 and 600 pounds of high explosive and a contact detonator; 2. A compressed air compartment, with air under pressures of from 2,500 to 2,800 pounds per square inch; 3. An "engine room," containing oil and water tanks, a miniature steam engine, a gyroscopic pilot and directional rudder control, and, 4. A set of twin propellers which drive the torpedo (they revolve in opposite directions to do away with torque). These naval torpedoes are generally 21 inches in diameter.

Aerial torpedoes, carried by torpedo planes, are smaller than naval torpedoes. They are generally 18 inches in diameter and are from nine to 12 feet long, carrying about 400 to 425 pounds of high explosive. Their mechanism is much the same, however.

Torpedoes are fired by compressed air from submarines or launched from the decks of boats, sometimes by a small charge of black powder. Before they are launched, the direction of their run and the depth at which they are to run are set by means of a small dial on the side of the missile. The gyroscopic compass will hold the torpedo on a true course, regardless of sea currents or regardless of the direction in which the torpedo is originally fired. It is possible, for instance, to set a torpedo to run northwest and fire it in an easterly direction. Once fired, the projectile will turn in a circle until it is on a northwest course, then will make its run. A hydrostatic device connected with a horizontal rudder keeps the missile at a constant depth.

A starting lever is tripped as the torpedo leaves its tube. This opens a valve which lets a blast of compressed air start the main motor. The steam engine then is set in motion. Steam, gas and compressed air generate more than 400 horsepower to drive the "tin fish."

The mixture of steam, gas and air is exhausted through the propeller shaft. Although, in new torpedoes, the steam is condensed upon striking the cold sea water and thus leaves less of a wake than old-style projectiles, still the gas and compressed air of modern torpedoes rise to the surface to leave a tell-tale streamer by which such carriers of destruction can be spotted.

It is MECHANIX ILLUSTRATED's hope that the Navy Department can utilize this torpedo killer.

Build A Model Submarine

[*Continued from page 154*]

a 1/8" square breech, 5/8" long, with the details glued on, as shown. Or purchase it. However, since a good imitation is hard to get, it is suggested you do build it up, adding details, base and "A" frame from the plans and drawings.

Aft of the gun is a bitt and the main escape hatch. Make from balsa or pine. The hatch is dome shaped, 5/8" in diameter. The mast is made up of 1/8" dowel with pins, clipped off, and soldered to a "T" shape. Brace at the front with 1¼" long wire, sunk 1/16" into the deck.

There is another hatch and bit and then the aft escape hatch, made the same as the other, except that it is only ½" diameter. Finally the second

BUILD FROM BLUEPRINTS! See special list of craft blueprints on page 174.

capstan, and aft light and post 3/8" long. A white or clear bead is placed on top with a disk 1/8" diameter glued to the top of it.

Last of all come the railings, made from headless pins sunk 1/16" into the deck, about 11/16" apart and extending 3/8" above the deck line.

There are 35 posts on each side. Atop them No. 28 wire is carefully soldered to each post, after first being inserted into a hole drilled into the deck 5/16" in front of No. 1 post. See the drawings. This is the upper rail. The lower is thread glued on, as indeed the upper may also be, if desired. However, it does not provide enough strength and snaps under the tension. Notice that the lower rail goes only to the gun, is broken, and then continues to the stern. All are fastened to the post supporting the aft light.

Paint the details to match the hull, gray or black. For contrast white thread may be used for rigging, though black is suggested, for it is correct. Clear glass beads should be used as insulators, and glued in position so they don't slip. The same goes for all rigging fastenings.

When you have finished the model you will have a sleek boat that will have been well worth the work you put into it.

THE JAPS SAY . . .

***"In our relations with foreign countries, the object should always be to gain control o v e r those countries."*—Lord Hotta, former Jap Premier.**

AMERICANS SAY . . .

Are we going to let the little brown men get control over us? If not, let's buy more and more of those War Bonds and Stamps!

Welding—This War's Revolution

[*Continued from page 77*]

of active gases. The welder uses a torch fed from gas tanks. This equipment costs comparatively little and gives a poor man with a knack with tools opportunity to set up his own business. Tanks of gases do cost a good bit. Yet the money the shop owner can charge for job work can give him a good livelihood.

Atomic hydrogen is another flame maker. Through an arc between two tungsten electrodes (which will not melt) pours a stream of molecular hydrogen gas. The intense heat breaks the molecules into hydrogen atoms. These atoms immediately recombine into atoms. But in doing so they form a finger of flame that fuses what metals it touches. Welders find atomic hydrogen particularly useful for working with thin sheet metal and with certain non-ferrous metals and alloys.

Arc welding is the process used in great construction jobs, such as ships. There are two kinds of arc welding apparatus—those that use carbon and those that use metal electrodes. In metallic arc welding the work piece itself forms one electrode. The other electrode is a piece of wire (held in a holder, of course) which moves across the work as the arc flames between them. The arc melts both the work and the tip of the wire. Tiny globules fly off the wire tip and make the weld. The carbon arc produces a nubble of flame into which a filler rod is fed. Arc welding produces 6,500°F.

Shielded Arc

MOLTEN steel has an affinity for oxygen and nitrogen. Oxides and nitrides form and weaken the steel. In casting, forging and rolling original steel, the processor takes great pains to keep these harmful inclusions out of his metal. The arc welder is apt to put them both in. To prevent this he invented the shielded electrode. This special electrode is covered with any one of several substances. In the heat of the welding arc the coating vaporizes and produces carbon monoxide: This gas attracts oxygen much better than steel does. It also blows away the atmospheric oxygen and nitrogen that might do harm.

Technique Of Welding

To make a weld the welder slowly moves his torch or arc along the joint, feeding his welding metal as he goes. The base metals fuse together and the welding metal fills up open spaces. It also reinforces the joint. The operator must have a steady hand. He must work at a certain speed fixed by the metal in the base, the welding metal, the source of heat, and the structure he is working on.

For example, to arc weld a fillet to a plate the welder ordinarily holds his electrode at about 45° to the plate and 60° to the line of the weld, with the tip of the electrode pointing backwards. He thus may weld some 35 linear feet an hour.

"Fleet-Fillet" Welding

Last March President James Finney Lincoln of the Lincoln Electric Co. of Cleveland, the most enterprising as well as the largest maker of arc welding equipment, announced a faster and surer system of welding. He calls it "fleet-fillet" welding. For this he uses a well-coated electrode and holds it perpendicularly to the line of the weld (instead of at the usual angle) and at from 45° to 60° to the plate. He keeps the arc very short with the coating of the electrode actually yet lightly touching the work. By this method he can weld up to 65 linear feet an hour, which is more than double the usual rate. And the weld penetrates deeply into the angles where filler and beam join. The joint is stronger than the base metal, says Mr. Lincoln.

By helping out with ideas, by research and by good salesmanship, Lincoln Electric has cheapened and popularized welding. In 1915 they charged $1,550 for a certain welding machine. A similar machine now costs $380.

Welding's artistic salute—Union of South Africa's new war time stamp costing 6 pence.

Buildings

Cities have feared to let skyscrapers be constructed by means of welding instead of by riveting. The present success of welded ships will certainly pave the way for acceptance of large welded buildings. Cleveland has just taken a safe chance and allowed the Commercial Bookbinding Co. to put up a 200x245 ft. building with all joints welded. The contractors saved 40 tons (30%) of steel over a riveted job. In another section of Cleveland, currently experiencing a housing shortage like so many other war-industrially busy cities, a medium-size one-story house was completed this spring to form another marker on today's amazing way of welding progress. The house is built of steel panels welded together! Observers think the giant steel companies will turn to promotion of this sort of house when war's end sends them seeking new markets for their expanded production. If steel costs can be got down, think how little depreciation such weather-, vermin-, termite-, rot-, and fire-proof houses would suffer!

[*Continued on page 158*]

Welding—War's Revolution

[Continued from page 157]

In the construction of ships welders are now in their glory. The U. S. Maritime Commission figures that, by allowing welding in 705 ships, it has saved 500,000 tons of steel. The steel is worth about $24,000,000 and is enough to build 227 extra cargo carriers.

Engineering ingenuity as well as welding skill must be applied in order to bring such savings about. For example, the Western Pipe & Steel Co. at San Francisco all-welds ships 450 ft. long by assembling and welding huge sub-units—double-bottom sections, decks, bulk heads, etc.— in shops near the ways. As soon as a way is free for new ship construction, sub-units are hauled onto the way and riveted together. This is line assembly on a stupendous scale. Sun and shadow, fog and rain, wind and welding heats, warp the steel every which way as the ship takes shape. Recently Editor Thum watched one of these ships going up. A reference point on the hull, said he, "wandered around like a fly on a 1½-in. ball." Some 200 welders turn out one of these 450-ft. hulls every 80 days.

At Bay City, Mich., the Defoe Shipbuilding Co. produces a 173-ft submarine chaser every week by welding it in sections and upside down. A cradle turns the completed vessel right side up and lets it slide into the water.

At Pittsburgh, where they are building the first local warships since Civil War times, the Dravo Corp. also builds sub-chasers in sections and upside down. Gantry cranes right the sections and welders then join them.

Salute

When a skill such as welding deeply affects the lives of people artists and poets rise up to salute that skill. Welding now has its artistic salute. This winter the Union of South Africa issued six-pence stamps in honor of welding's part in constructing ships, tanks and aircraft to destroy the enemies of democracy. The stamp shows a welder wearing his head shield, gloves and special clothing as he applies an electric arc to a piece of work.

Now where is welding's poet?

50c WELDING OUTFIT

How you can build an inexpensive welding outfit for use in a home workshop is told in the how-to-build section of the August issue of *Mechanix Illustrated*. It's just one of the many helpful, workable projects lined up for this big midsummer issue! On sale July first—still 10 cents!

Proper Care For Blow Torch

[Continued from page 133]

being used in the pre-heating cup to soak up the pre-heating gas. Kerosene, alcohol, or gas may be used with this type of "wick" and is in less danger of spilling if the torch should be accidentally overturned.

Figure 8 illustrates the asbestos hood designed to hasten pre-heating. A slot is cut in it for the hook.

As the gas and vapor tend to dry out the leather plunger on the pressure pump, an occasional application of medium weight clean motor oil is necessary. Apply the oil as shown in figure 9. Another simple trick in maintaining the performance of your torch is shown in figure 10. This consists of removing soot from the generator. As this type of deposit acts as an insulator it will slow down the pre-heating operation if it is not removed. A round bottle brush with stiff bristles is useful here.

Figure 11 illustrates the method of cleaning the gas tip face. A stiff-bristled long handled brush is inserted through the generator tube and rotated to do the job. To prevent a dislodged carbon particle from entering and clogging the hole, it is wise to open the valve slightly so that a small amount of gasoline will flow out, keeping the hole cleansed.

When cleaning a plugged hole in the torch tip, don't use a "crow bar." Use a fine sewing needle that will slide freely through the hole. If it is too large it will bind, and may possibly spoil the tip. Figure 12 shows the proper way to use the needle. If you can't find a small enough needle, a small piece of wire taken from a fine gauge screen as shown in figure 13, will solve the problem. If tip isn't removable, insert needle in a dowel to use it.

If you do accidentally enlarge the tip hole you can often bring it back to normal by inserting a needle of the proper size, and making small dents in the metal all around the hole. This will force the metal in toward the hole, reducing it to proper size. See figure 14.

To remove hard carbon from the tip face, and to keep tip face at right angles to the hole, use an ignition point file as shown. A file of this type is thin enough to fit into the small slot between the tip face and the rear of the generator tube in the type of torch illustrated.

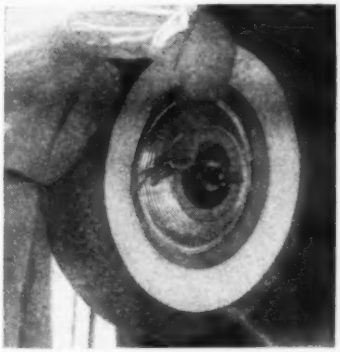
A final but important precaution is shown in figure 16. Keep a can of sand and a scoop on hand—in case of accidental fires.—*W. C. Wilhite.*

Florida's great white herons, hunted nearly to extinction for hat plumes about 30 years ago, are now increasing.

A series of elevators installed in Grand Coulee Dam will enable visitors to go nearly 1,000 feet under the surface of the Columbia River.

What's Your Car Trouble?

If you have a problem with your car, ask Mr. Russell. Just send stamped, self-addressed envelope for a personal reply.

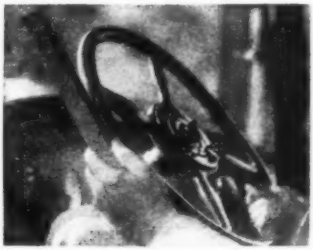


by Frederick C. Russell

Is it necessary to remove a rear wheel when you merely want to check it for static unbalance? H. L. P.

Yes, it should be taken off and spun on a dummy axle. The rear end gears would upset calculations if the wheel were left on the car during the test.

The engine of my car won't start except by towing. It has a solenoid starter control which I do not understand. B. T. E.



In this system the starter is grounded through the generator brushes, so check over the generator carefully. The arrangement prevents damaging the starter gears should you accidentally press starter with engine running.

How much play should there be in the steering wheel? W. L., Jr.

This is a matter of taste in driving, but the play should never exceed one and one-half inches measured at the wheel rim.

Is there any special wear on the front tires to indicate excessive camber? S. N. G.

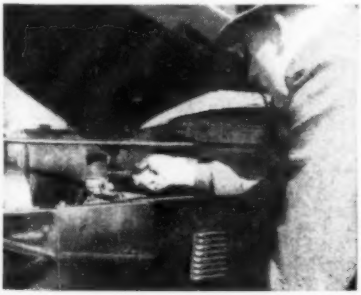
The tread will be worn excessively on the side away from the car.

There is a bad squeal in the right front brake of my car. Shoes are not dragging as the wheel does not heat up. M. P. F.

Check to see if backing plate is loose or shoes twisted.

Once in about every ten shifts there is difficulty getting into gear with my fluid drive car. Is this transmission trouble? M. L.

No. The mechanical clutch is dragging.



My engine has suddenly started to make a loud sucking noise. Have you any idea what this could be? L. H.

The air cleaner has come loose. Be careful not to cramp the carburetor intake flange when you tighten up the band.

In storing extra tires should they be kept inflated? W. F. W., Jr.

Rubber experts say that tubes will last longer if not inflated. However, a new tube should be taken from its carton and given enough air to take out the folds.

Suicide March Of Lemmings

[*Continued from page* 60]

a good trapping season the following winter. Hence, I extended liberal credit to the Eskimos with every assurance that they would bring in good catches of fox pelts during the trapping season and liquidate their debts.

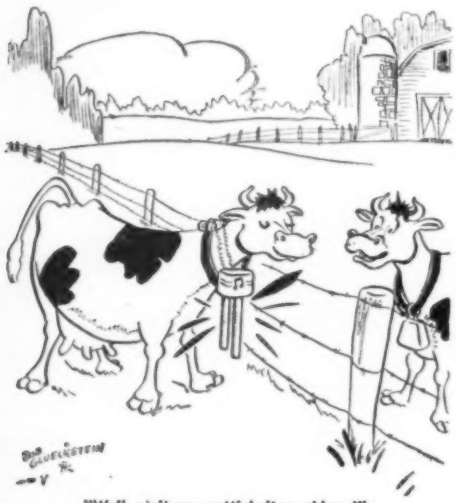
(Editor's Note: B. W. Cartwright, chief naturalist for Ducks Unlimited, says that this is the most astute application of bird observations to practical commercial ends he has yet encountered.)

These rapid appearances of large armies of lemmings, moving slowly and steadily in the same direction, swimming streams and lakes, disregarding all obstacles on their march, have given rise to the belief that the tiny animals were probably showered from the clouds, or that they are still obedient to some vague instinct which prompts their search for an ancestral home in a submerged Atlantis.

Authorities claim, however, that the restless migrations begin as a result of over-population in their normal dwelling-places. Whole swarms of lemmings start toward the lowlands—as though led by a phantom Pied Piper—following valley courses, always moving in one direction, until they reach the sea.

That thousands drown in the ocean does not mean that they are willingly committing suicide. It is now generally agreed that lemmings do not blindly head out to open sea without having some land objective. Even in Norway, where the suicide migration story originated, it is believed that migrations are from one point of land to another.

Word has just come down out of the North that lemmings are again abundant. Obviously the four-year cycle of abundance to which these animals are subject is a matter of scientific interest.



"Well, ain't you gettin' ritzy—chimes!"

Lawn Mower-Barrow

[*Continued from page* 125]

ordinary length shaft. The bottom consists of a piece of plywood 36 in. long by 24 in. wide. Sides are 36 in. long, 18 in. high at the front ends and the top is cut back at angle to meet the back ends at a point. The front panel is 18 in. by 24 in.

Brad these all together to form an open topped triangular box. Then cut length of "ground" (¾ in. square spruce) to form a tight fitting frame to which the various panels may be nailed or screwed solidly. These are indicated by dotted lines.

Nail a strengthening piece of wood under the open end and through it fasten a ¼-in. bolt that will fit down through a hole in the mower shaft as indicated. Then, about 6 in. back from the front end nail a second thin bar of wood across and below to which should be fastened two roller clamps. Place these in line with the length of the basket and back about 4 in. from each side so they will clamp around the roller. The two clamps are fashioned of spring steel mush after the pattern of the old bicycle "trousers guards" worn by bicyclists.

It is a quick operation to turn the mower upside down, sit the basket on the shaft, push the rear bolt down through the hole and push the roller clamps in place. If desired, run a nut on the bolt to prevent it from jumping out, but ordinarily this will not be found necessary.

A swinging leg of round iron can then be permanently pivot-bolted to the side of the mower shaft as shown. This can be swung up close to the shaft when not in use but can be swung down to act as an elevating leg when loading the basket.

Remove the basket, swing up the leg, turn the mower right side up and the mower can be used for grass cutting as usual.—*L. B. R.*

Plywood Proa

[*Continued from page* 138]

through the plywood bottom. Note that the stem rabbet is straight so that it may be cut quickly on the circular saw, instead of chiseled out by hand to a curve. The cutwater, or forward edge of stem, is curved to improve the appearance of the canoe.

Outrigger poles are lashed with hemp cord or marline. One of the poles is relatively stiff, but the other lighter, and limber to permit weaving action through the waves without strain on the structure. The Kanakas lean away from the outrigger when they want to make speed, as this lifts the latter higher in the water with less resistance forward.

A dark stain on the plywood is effective when set off by a bright-colored decoration, as indicated.

Some of the newer electric ranges have lighted ovens—the light flashes on when the oven door is opened.

Bombardier

[*Continued from page* 38]

and reports this to the pilot. Time seems to drag, but soon flak (anti-aircraft fire) begins to burst and they know they are on the outskirts of the target city. The AO is hunched over his bombsight now.

Nearer and nearer comes the center of the objective, seeming to creep, to the bombardier peering through the bombsight. Then—the big moment—he presses the button that releases one of the 500-pound bombs. The plane wings onward, changing course to confuse the anti-aircraft guns and searchlights that reach into the sky.

As the plane swings away from the target to prepare for another run over it, the pilot sees another bomber outlined in the searchlights. It is below and to one side. He silently cheers, knowing his companions have also found the objective. Now he peers around, trying to spot enemy fighters that may have been sent up to intercept them. He correctly surmises that the fighters they had met earlier were supposed to have done the job. How well they stopped the other bombers won't be known until the big plane gets back to the home aerodrome.

Five times more the big bomber braves the hail of flak as it makes runs across the target, following the AO's instructions. The AO is boss of the show now. The pilot notes that flames are shooting up from the objective and grins happily in the knowledge that some of the bombs have scored.

The gunners have come to life again. That means fighter planes are again menacing the bombardiers, but the load has been dumped and the bomber heads for home, making it a running fight. Bullets from the fighters have scored now and the bomber's starboard gunner fails to report to the pilot's inquiry. He motions the co-pilot back into the fuselage and a few seconds later hears his voice, "Taking starboard gunner's place, sir."

The bomber maintains a steady course, depending on its armament to carry it through the attack. You can't toss these big planes about like the nimble fighters. Then, just as suddenly as it started, the attack ends. The fighters with their limited fuel have had to end the fight and return to their base. The bomber pilot mutters a prayer—"Now if we don't run into some more over the Channel we'll be okay."

The AO calls the pilot, telling him to change course a few degrees because of a cross wind that has developed and drifted the bomber off course. With a mental comment—"The kid's all right. On his toes."—the pilot changes to the new course.

The fates are kind tonight and the bomber meets no opposition as it crosses the Channel. Within ten minutes it is hovering over the home aerodrome, signals, gets an okay to land. A few minutes later the tired crew discusses the raid with intelligence officers over sandwiches and coffee.

Our AO is happy. Didn't he navigate a big bomber to and from a target over a 1,500-mile trip? Didn't he drop a stick on the target? Hell, he's an oldtimer now!

* * *

Listening to broadcasts or reading published reports of RAF bombing raids into Nazi Europe like the foregoing one, Americans must often wonder what special knowledges and training must be possessed by the cool-headed, able men who comprise the Bomber Command. Military rules of course now prevent you from visiting a training base, or even talking about their duties with the bombardiers. But let me take you as far as permitted behind the scenes in the process of developing a bombardier . . .

A BOMBER, unlike a fighter aircraft, is flown not only by the pilot, but also by the air observer (AO), the wireless operator (WAG), and the air gunner. They comprise a team and the success or failure of the flight depends on closest cooperation.

The captain and his co-pilot do the actual flying; the observer navigates the aircraft both to and from the objective and also drops the bombs; the wireless operator assists the air observer and also serves as an air gunner.

"I'm checking this time-bomb."

The bomber pilot differs in training from the fighter pilot. He must be capable of considerable physical and mental endurance, for he may be aloft for periods of ten, eleven, or twelve hours at a time. He is a skilled navigator as well as pilot of huge twin- or four-engined aircraft weighing many tons.

Actually, however, the Air Observer can

[Continued from preceding page]

be claimed the most important member of the bomber crew. The hazardous journey of a costly bomber over enemy territory would mean little if the AO has not navigated it to a precise position over the objective. It would still mean nothing if, once over the objective, the AO lacked the skill to operate his bombsight so that the bomber's load of death could be dropped on or close to the selected target. This means "planting" a load of bombs on a pin point a mile or more below, making due allowance for the bomber's airspeed, the wind speed, drift, altitude, etc. For example—if a bomber is flying at 10,000 feet at a speed of 200 m.p.h., a 500-pound bomb will strike the ground more than one and one-quarter miles AHEAD of the point where it was released.

Under the British Commonwealth Air Training Plan, the training of Air Observers for all the air forces of the British Empire is carried out mainly in Canada at Air Observer Schools and Bombing and Gunnery Schools. Candidates are sent to an Air Observers School only after weeding out at an Initial Training School.

At the Initial Training School the AO candidate attends classes in mathematics, administration, Air Force law, hygiene, and other pertinent subjects. Of course, the usual periods of military drill are part of the daily routine.

Upon graduation from the Initial Training School, the future AO goes to one of the Air Observer Schools. Here he learns to use the tools of his job—map, chart, compass, camera and bombsight—with speed and efficiency. The elementary instruction is given in classrooms by means of lectures, blackboard diagrams, and motion pictures.

Practical instruction is given in twin-engined Avro-Anson aircraft, called "flying greenhouses" by the men because so much of their fuselage is comprised of window space so that the student observers can study the terrain on either side while in flight. Although unimpressive in appearance, the flying qualities of the Ansons make them ideal for navigation training.

Student AO's put in many hours of navigation exercises aboard Anson aircraft, of which a certain percentage of hours are at night. They fly in all kinds of weather and are checked periodically to determine their progress. The final test consists of a triangular flight on which they tell the pilot where to go, using different methods of navigation for each leg of the flight. Radio orientation is used only in emergencies, inasmuch as on real raids over Germany radio beams are non-existent.

The course at the Air Observer School is study, practice, study, practice, day after day, night after night. The use of weather reports, flight computers, compass, and slide rule becomes second nature. Quality is the keyword and no student is graduated until he has proved his ability. Sight is never lost of the fact that the success of a future bombing mission, as well as the lives of several trained men, will depend on the skill acquired by the Air Observer during his training days.

YES, that's the sensational statement of this man-who-should-know, John Walter Christie, designer-engineer of tanks as fast as lightning and mighty as juggernauts which are now fighting for the United Nations on world battlefronts. His newest, most ingenious development is already termed "America's wonder weapon"!—a low-slung tank which can be deposited at strategic points by Flying Fortresses flying 90 m. p. h. and with destructive potentialities so great that, Mr. Christie says, 10,000 of them in the possession of the U. S. would bring the Axis to its knees in 60 days!

The story of this inventor—little known except in high war councils—and his latest, secretly-built tank, is MUST reading for every American who hopes for peace. Don't miss this amazing interview between Mr. Christie and MI's aviation editor, George E. Daniels,

in next month's MECHANIX ILLUSTRATED

Upon leaving the Air Observer School, the student AO heads for a Bombing and Gunnery School. Here he again spends hours in the classroom, but now the subject is bombing instead of navigation. He alternates between the lecture room and practice bombing flights made at high and low altitudes.

In the classroom the student AO learns the theory of bombing from A to Z. He studies the chemical and construction features of all types of bombs of varying weight. He practices releasing bombs by means of mechanical devices, although they fall but a few feet in these trial drops. On an indoor bomb range he learns to operate a bombsight.

The indoor bombing range consists of a specially constructed tower about three stories high. At the base is a scale relief map mounted on a me-

chanically operated turntable. On the third floor, overhanging the scale map below, is a platform on which a bombsight is mounted.

By lying on his stomach atop the platform and peering through the bombsight at the map below, the student AO gets the impression that he is in an aircraft over enemy territory. As the map rotates, the student lines up the selected target in the bombsight, makes his computations for speed, drift, etc., and presses a button to signify the releasing of bombs. The results of his computations determine the accuracy of his aim and an instructor records indicated hits and misses. (Editor's Note: Photographs of this set-up were shown on page 54 of the June issue.)

For practical bombing experience, the student AO goes aloft in Fairey Battle or Bolingbroke aircraft. Eight 11½-pound practice bombs are loaded in racks under the wings and the pilot flies the aircraft out over a range on a nearby lake.

Reaching the designated altitude, the pilot sets a course (or courses) as directed by the student who is lying on his stomach on the bottom of the aircraft's fuselage, peering through the bombsight he has learned to operate on the indoor range. Through an inter-phone system, the student bombardier directs the pilot—"Steer 180 degrees—steady—five degrees port, sir—steady—bomb released, sir!"

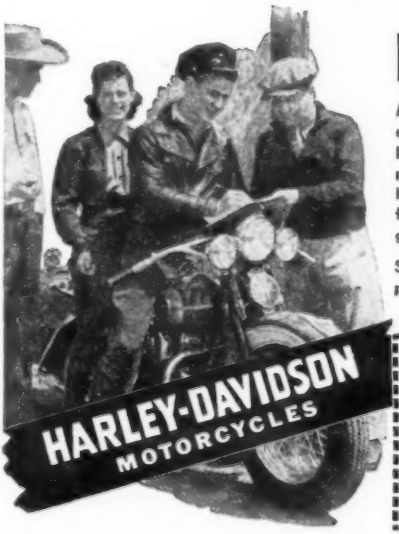
The 11½-pound practice bombs are filled with chemicals which cause the release of heavy white smoke when they strike the target (a wooden float) or water. Surface observers note the accuracy of the bombardier's aim, tallying the hits and misses. The student is graded according to the number of hits made or how close the misses are to the target. After hours of this type of practice, students gain considerable skill. Near the end of the six weeks' course, hits far outnumber misses.

Upon completion of the course at the Bombing and Gunnery School, the student AO is graduated as a Sergeant Observer and is entitled to wear the Observer's Badge—a half-wing with a large O on the left breast of his tunic.

The bombardier is not finished yet, however. He must still take a post-graduate course, in effect —instruction in astronomical navigation at a special school, learning to navigate an aircraft by the stars and moon at night, and by the sun during the day. The sextant and plotting sheet become his tools in this training period, of which much time is flown at night. He's also given advanced bombing instruction.

Ready now for overseas duty, ready to take his place as kingpin of a bomber crew, the AO is eager to strike with the techniques he's earnestly, with much work, mastered. After a short embarkation leave, he boards ship for ——. Not long afterwards he's installed in one of the great bombers, heart beating fast, ready for war!

ALL OUT FOR *Victory* WITH



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Admiral Of A One-Man Fleet

[*Continued from page* 71]

United States Navy, sent around the world by President Theodore Roosevelt, steamed one by one into San Pedro Harbor. Then a young electrical student, Bixby stood on the hills overlooking the water and watched the gray, sleek craft slide into port, and ambition flooded over him. He was going to have a navy of his own. He began to plan.

But his career intervened and he worked long hours and many years as an electrical engineer in Glendale, Cal., before he could take the time to turn to what lay closest to his heart.

Ten years ago his opportunity came and he set to work. It was only last year that he reached his goal with the completion of his last ship. He estimates that he worked more than 15,000 hours in all on the entire armada and values his ships at $10,000.

With installation of the final bit of equipment in the last ship, Bixby was selected recently by Dave Elman, conductor of radio's "Hobby Lobby" show to demonstrate how one of his models operates. He put the *U.S.S. Oregon* through its maneuvers before a nationwide audience.

Bixby gets a lot of quiet fun out of being head man of his own fleet. One day a blank exploded unexpectedly and the wadding pierced his thumb, lacerating it badly. Taken to a hospital, he was asked the cause of his injury and replied he was shot.

All shooting cases must be reported to the police and Bixby was duly summoned before a police captain. "How were you shot?" asked the officer.

"By a gun."

"Where was the gun?"

"On a battleship."

The captain exploded. Summoning a policeman, he ordered Bixby locked up until he "came to his senses." At that point, the admiral thought he'd better explain and exhibited photographs of his fleet to the amazed captain, who blurted:

"I'll be damned. You're the first man ever to be shot by a battleship who ever showed up at this police station!"

There was the time in 1938 that Bixby was seized on suspicion of being a spy. He had boarded the *U.S.S. California* . . . the real thing . . . on Navy Day and was industriously measuring a gun turret with tape and square when he was collared.

Hustled before the commander, he produced documents which convinced the officer that his prisoner was only a zealous hobbyist getting dimensions for his models.

How to Make Your Car Last for the Duration!

Read practical suggestions by MI's automobile expert, Frederick Russell, in the August issue, on sale July 1.

Repairing Damaged Valves

[*Continued from page* 119]

happens. Furthermore, the repair job is easy, inexpensive and permanent. Here's how you do it: First, of course, you must remove the wheel with the crippled tire, and take the tire off the rim. Next, obtain a valve unit of the type used on the inner tubes of "balloon" bike tires. These valves are equipped with two oval, curved flanges and a nut for tightening. They cost about 25c. You'll also need an inner tube patch and some rubber cement.

With a razor blade cut off the rubber nipple that held the old valve. Slit the casing over the hole. The slit must be a little longer than the width of the flange on the new valve, and be a clean cut through the casing. Now work the valve, with bottom flange attached, through the slit and turn it once it is inside, so it points along the length of the tire. Coat the whole outside around the valve with rubber cement. Make a hole in the tube patch to fit snugly over the valve stem and press the patch down firmly over the incision. Slip outer flange on and tighten nut.

Partially inflate the tire and test for air leaks by holding valve section under water. If you've done a careful job there won't be any leaks and you can replace the tire on the rim *for keeps*. Should a thin stream of air bubbles rise in the water, remove flange and patch, then apply more rubber cement and a new patch. If the latter is adhering properly, and the nut is tightened down hard over the flange, the repair will be airtight and stay that way.

Compact Battery Charger

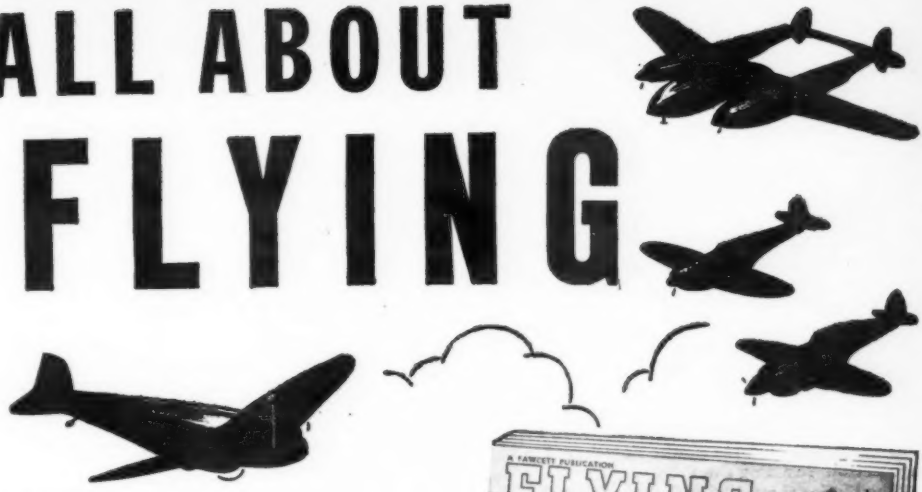
[*Continued from page* 137]

in two oak cradles, as shown, and anchored with a bar-iron loop over the top.

The universal coupling consists of two flanges, each connected with a stout cowhide disk with bolts, two in each flange and located 90 degrees from the two in the opposite flange. Spacing collars are slipped over the bolts. These flanges are made by cutting the vee-perimeter of a 5-inch standard pulley. Or it may be left on to hook up with other machinery. Note that the flange on the engine shaft has a 2-in. diameter hub, with a stud protruding from it about ⅜-in. This stud serves as a set-screw as well as a hold for the starting rope looped around. A taper pin through hub and shaft also secures the flange.

In tests this unit has shown remarkable efficiency, a nearly "dead" battery being brought up to normal in better than average time and producing a tremendous spark. At the proper charging speed the engine will run approximately four hours on about one quart of gasoline. The original was built for installation in an auxiliary sloop, and the same unit is adaptable to cabins, trailers, camps or uses around the shop.—*Hi Sibley.*

ALL ABOUT FLYING



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Streamline Your Stroke

[*Continued from page* 107]

middle should be the limit. Now drop the oars into the water just deep enough to cover the blades.

The pull-through should begin the instant that the blades are in position for a full grip on the water, and should begin with your back alone, your arms remaining fully extended. As your hands come back they will approach each other and at the middle of the stroke they should overlap, the left being commonly on top. (Fig. 7.) At this point you will find the pull of your powerful back muscles beginning to weaken, for they are approaching the limit of their contraction. While they are doing their best work, however, they should do it alone.

Not until your hands begin to diverge should you allow your arms to "break" somewhat sharply (Fig. 8) and exert their help, in order to maintain a uniform power flow into the blade against the resisting fluid.

The blades should be just covered by the water and no more, and should be pulled through on a level and squarely at right angles to the water. You should pull slowly and evenly at the start, quickening your pull as your body nears the end of its backward swing.

The pull-through is completed with the finish —a quick powerful jerk of the oars that brings your arms close to your sides (Fig. 9), thumbs touching your body, and the oar blades smartly out of the water. Your body will be slightly behind the perpendicular. It is this finish which gives your boat its momentum.

As the oars leave the water, drop your wrists easily as shown in Fig. 10, thus rotating the oar-shafts and turning the blades nearly flat on the water, and shoot your hands out until your arms are straight. One hand, commonly the left, leads by about six inches until the oar handles have

[*Continued on page* 167]

"He's waiting for a blackout—so he can develop some films!"

Tap Water From Well

[*Continued from page* 136]

of the tank fit as large a check valve as possible. These should allow the water to flow in but not out. Fit the two top openings with reducing bushings—one ¼" and the other ¾". The ¾" pipe should be extended by a long nipple to drop inside the tank to within a few inches of the bottom. This is the water discharge pipe. The ¼" air pipe ends just inside the top of the tank. With couplings, fit in as long sections of pipe as can be handled and lower the tank vertically in the well so it sits upright on the well bottom. With more pipe and elbows, trench the pipes to a suitable working space in the house. As a safety factor, the two check intake valves may be screened to prevent the ingress of dirt. The tank should sit completely under water.

For use in a spring or pond, the same general procedure should be followed except the air and discharge pipes are fitted into the side openings and the check valves into one or both ends. Support the tank on its side if the water is shallow.

In either case make all other openings airtight.

Pressure is obtained by either a hand, foot or power air pump. In either case a check valve to prevent the air pressure from flowing back into the pump must be provided somewhere in the air line. As pressure is built up inside the tank the water is forced up the discharge pipe where it can be drawn off in the house or building. When the water is lowered in the tank, the pressure can be released by an air valve and water will again fill the tank through the check valves.

All this is shown in the detail sketches. If a small power pump can be utilized you will have an almost ideal pressure system. As pressure builds up to the point where the automatic valve in the water line will open an electric switch, the power is automatically thrown off of the motor and the pump stops. A secondary hand switch should also be wired in so this operation can be handled manually if desired or if necessary.

Thus your well or spring can be modernized at small expense and from used parts and piping capable of withstanding thirty or forty pounds pressure.—*L. B. Robbins.*

Two-Faced Picture Frame

[*Continued from page* 146]

together again. Note that dowels extend close to finished edge, as a precautionary measure to prevent breaking. Shape to finished size. Round the inside edges of the prongs and carefully sand all parts. Finish with three thin coats of shellac, rubbing down well between coats. Cut two pieces of glass, being sure to cut them accurately, so that when assembled they will fit tightly. Spread the feet to insert the glass encased pictures, and slip on the base clip, which locks the frame securely.

Streamline Your Stroke

[*Continued from page* 166]

passed each other. As soon as both arms are straight, the body starts its forward swing, completing the shoot or recovery.

The oar blades must not be too flat, lest the water catch on their upper sides, and the rougher the water the more must the front edge be turned up. Professional oarsmen call this "feathering," and its value is that it carries the blades back swiftly and with the least resistance. It is a distinctly worth-while rowing accomplishment to be able to feather in a sweeping recovery that never touches the surface and yet is never half an inch from it.

As soon as you reach the catch position again, don't delay. Drop immediately into the next stroke without any additional lifting motion except to raise the wrists and so let the blade turn straight just before it cleaves the water in an effortless downward curve, catching strongly for the next pull.

Practice the details of your stroke until all are merged into the steady, slow-working rhythm of a pumping-station engine. Rhythm is important. Many a skilled oarsman has improved his stroke by humming an accompaniment to himself. Something in three-four time, or waltz rhythm, is best.

When your new stroke has become more or less second-nature, you can turn your attention to improving your grip on the oars. This will consist in loosening it up into something approaching Fig. 11. The second and third joints of the fingers should be curled round the handle, with the last joint of the thumb resting against the end of it. Fingers, instead of touching, should be kept well apart. You will find that such a grasp gives you far greater control over the oar than the fatiguing grip in common use. The skin of your hand will also keep drier and cooler, and thus be less likely to blister.

When the water is smooth and there is no strong wind and no current to row against, a long, steady stroke is best. When the water is rough, or you are rowing against the current, or the wind is heavy, a short quick stroke produces better headway.

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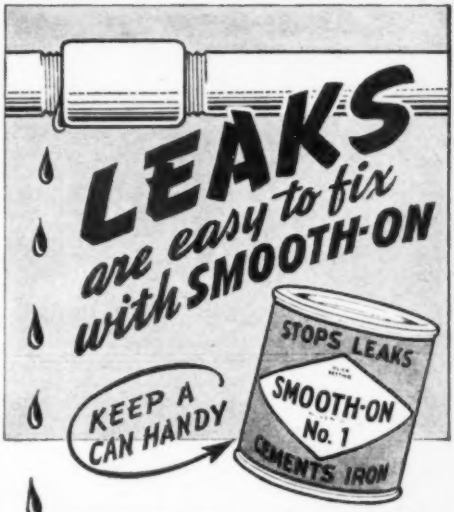

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Making Plastic Models

[*Continued from page* 110]

Blocks No. 1, No. 3 and No. 4 remain together. A coat of shellac and several heavy coats of wax are put on the shaped surfaces. Fasten cleats on the flat sides of all three parts of the body so that they may be held in a vise.

Tear the cloth into convenient strips between ½" and ¾" wide. Then mix up a small quantity of cold resin glue. Don't mix too much because what isn't used must be discarded.

The first ply should run across the mould. The cloth strip is first glued to the under or flat side of the mould. It is then stretched over the mould and glue is brushed on top of it. When the other

[*Continued on page* 169]

Correct Answers to Quiz on Page 78:

1. False. The Momsen lung is used in escaping from submarines.
2. True.
3. False. Haycocks are small piles of hay.
4. True. The term "clinker built" applies to lap-streak boat construction.
5. False. The term "prop wash" is applied to the propeller slipstream.
6. True.
7. False. Prestidigitators are persons skilled at sleight of hand.
8. True.
9. False. Scallions are vegetables.
10. True.
11. True.
12. True.
13. True.
14. False. Such snakes are more common in the South.
15. True.
16. True.
17. True.
18. False. They lay their eggs on the sea beaches in the moonlight during June and July.
19. False.
20. True.
21. False. A rhododendron is a plant.
22. False. They have traveled over 70 m. p. h. without tracks.
23. True.
24. True.
25. False. A lubber line is a stationary line on a compass.

Attention, MI Readers!

We will pay $1 for each true-false statement which we find acceptable. Statements will not be acknowledged or returned. Address the Quiz Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York City.

Checks have been sent to the following: Donald Sellwood, Toronto, Ont., Canada; Dan Papala, Cudahy, Wisconsin; Louis Korosy, Bronx, N. Y.; Mrs. G. R. Seeley, Emmet, Idaho; Frank Duffey, Milwaukee, Wis.; Mrs. Barrach, Hazel Park, Mich.; C. King, Chicago, Ill.; Lena W. Greenbacker, Middlefield, Conn.; Gordon Robertson, Norwood, Ohio.

Lillipuppets

[*Continued from page* 141]

your finger tips. Spread more on so that the parts look smooth and do not show the formation of the coils of wire underneath. Shape the head with special care. You will probably put on about three layers to make it look right. While the plastic wood is still soft, pinch out a pair of ears, also a nose and chin. Push in for the eye-sockets. Later you can remodel with a pen knife (Fig. 4), but no great detail is necessary.

Do not be afraid of having plastic wood get over the joints. You want them covered as much as possible as long as they work freely. Before the plastic wood hardens, work all the joints. This will keep any from setting within the loops. Make sure the head can nod, also turn in each direction. The arm and shoulder joints should work freely in all directions. The hip joints should be set so that the legs can be drawn up almost to the stomach. However, upper legs should not be able to bend very far backwards. In the same way, bend the knees just as you bend your own, but let some plastic wood stay in front so that knees cannot bend the wrong way. Now you can shape your Lillipuppets as you wish them to be, thin or fat. Later you can make your characters short or tall by varying the length of the parts, but stick to the suggested dimensions at first.

After you have your Lillipuppets smoothly covered with plastic wood, and all joints working properly, put them aside for a few hours so the plastic wood will harden thoroughly. Then you can make any corrections or additions you wish. Add on plastic wood wherever desired, or pare it away with a sharp knife, avoiding paring down to where the wire coils will show through. For a female character you may model on hair in various styles, also form bodily characteristics. You can model clothes right onto your characters, always being sure that the joints still work freely. With your knife, fix up the face, also shape the hands and feet a bit. Again, too much detail is not necessary.

When you are satisfied with your figures, and all the plastic wood is quite hard, you are ready to paint (Fig. 5). You can use watercolors or artists' oils. The first is easier, but the latter gives stronger color effects. If you have modelled on the clothes, then paint them as you wish. Otherwise, after the paint is dry you are ready to dress the figures. A bit of ribbon can be sewed around or glued direct to the body, but again be sure that nothing interferes with the free action of the joints.

This concludes the first of three articles on Lillipuppets. Next month we will take up the stringing and manipulation of the tiny marionettes.

Making Plastic Models

[*Continued from page* 168]

side is reached, the strip is again glued to the underside.

After the first ply is thoroughly set, apply the second ply lengthwise. In this case, glue is put *under* the strip, as it is laid down. Do about two or three inches at a time and brush the strip down well. This, and all succeeding plies are *not* anchored to the undersides of the mould, as was the first ply.

The next two plies are put on diagonally, at right angles to each other.

The fifth and final ply is put on lengthwise. Five plies give a thickness of about $\frac{1}{16}$". This is quite strong enough, but if more strength is desired, add more plies. The body should be allowed to cure for several days on the mould. It is then sanded and smoothed up, as was with the boat.

Let the body cure for several more days and then remove it from the mould by cutting the first ply at the corners with a chisel or sharp knife. (It may be necessary to unscrew blocks No. 1 and No. 3 and pry a bit with a knife blade if you didn't wax well.)

The chassis is a piece of ½" board. It is shaped to fit into the body at the seam. Holes are cut in it for the motor, fly-wheel and gears. Put these in place and install the wiring before the body is put on. The axles must be put on after the body is in place.

When the chassis is completed, glue on the bottom part of the body. (The part that was made on block No. 5. If brads are used to hold it while the glue sets, be sure to drill holes for them.)

Next, glue on the upper half of the body (found on blocks No. 1, No. 3 and No. 4).

While these are drying, carve a headrest from a block of balsa and glue it in place. Make supports for the hood, too. They should be strips of wood about ⅛"x¼"x1". Six are required. Two are glued under the top of the cowl to support the hood, and one is glued diagonally across each corner. Hooks for rubber bands that hold the hood on are bent from pins and glued in place. Drill holes for the axles; be sure they turn easily.

Now paint the car. If you put on a good coat of glue after you sanded, one coat should be enough. When the paint dries, make a radiator grill out of $\frac{1}{16}$" balsa or sheet aluminum.

A plate for the running line is made, too. Screw it *securely* into the chassis. It should be just a little forward of the center of mass.

The final step is putting on the axles and the wheels.

Many more designs are made possible with this type of construction than have been practical heretofore. In this article we have described a simple, typical model. However, don't let that deter you. By all means, design your *own* car. Put into it all your pet ideas and notions.

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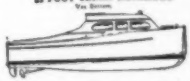

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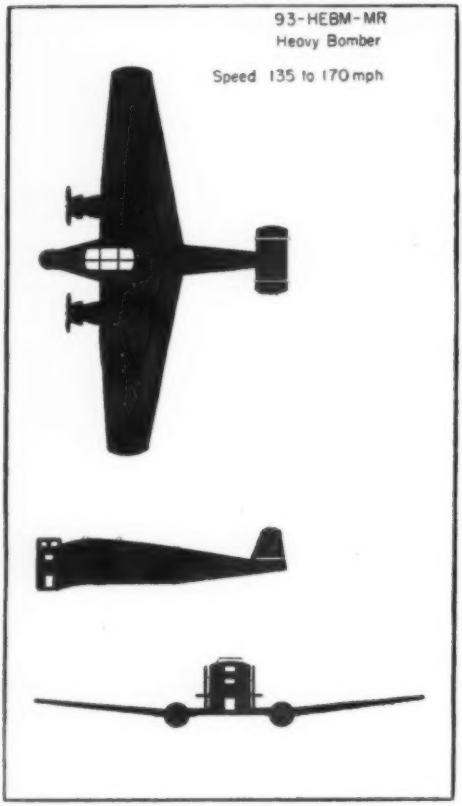
Jap Bomber's 2 Rudders Are Out Of Prop Wash



THIS Japanese bomber, suited only to bombing weakly defended points, was first put in production in 1933. Its maximum load of 1,600 pounds is small by comparison to more modern ships, but is extremely deadly when made up of incendiaries. Fire bombs of many types have come into wide use in the present war, and due to their light weight, can be carried in great numbers by craft that might well be considered obsolete for other types of work. It is interesting to note that the twin rudders on this ship are not placed in such positions that they can take advantage of the propeller wash. Twin ruddered German and other Axis planes almost invariably place the rudders in the propeller wash. Allied planes of similar design also take advantage of the added control effect. It is interesting also that the Japanese ships have unusually small control surfaces.

Victory Garden Work Kit

[*Continued from page* 127]

the point at which this piece is inserted and the design and size of the handle. The front and back cross pieces are the same length as the sides, 13", and as in the first box one of them 2" wide and the top edge is shaped to match the slope of the sides while the other is 3" in width. In making both the sides and ends a rabbet ¼"x¼" is cut at the bottom inside edge of each piece, to receive a piece of ¼" plywood.

This plywood piece is cut to fit and nailed in place, forming a bottom for the whole box. The top piece is shaped as shown in the drawing and is 13½x8½" of ¾" stock. Again, if a saw is not available to cut the curved lines a 1" bit can be used to bore a hole through the top at the proper point and a bench saw or band saw can be used to cut a straight line to it at each side. You will note that this lid pivots on two dowels which are inserted through holes at the back of the handle and glued in place. The back edge of the top is carefully rounded so that the lid will raise and lower easily without binding. When carefully fitted and sanded the box is ready for finishing.

These boxes can be finished with two coats of a good grade of clear varnish, using a shellac sealer coat first, or two coats of good outside paint can be used over a priming coat. In any event, be sure that the boxes are well protected with good materials properly applied. After the finish has dried, the pad is put on the top. A sponge rubber bath mat from the ten cent store is excellent and can be cemented to the top with the rubber cement used in applying tire patches. If such a pad is not available a cushion can be built up on the seat and covered with black oilcloth and this will be found just about as satisfactory.

A real dirt farmer might snort at one of these contraptions, probably would, but for the amateur gardener they are practical and not unattractive. Contrary Mary might never have become so irritated as to make those derogatory remarks about the petunia if she had possessed one of these handy little tricks.

Jig Saw Is Lathe Accessory

[*Continued from page* 131]

bears on the pin through the lower blade holder. A thumb screw holds the blade in place at the top end of the holder. A similar arrangement holds the upper end of the blade in the spring-return holder.

The entire saw can usually be built for around $5. For best results it should run at about 2,000 strokes per minute. If a blade breaks, the motion of the blade operating mechanism immediately stops, as the lower blade holder drops down, and the spring-return holder moves up and stays there.

The saw can be set up or removed from the lathe in about five minutes.

Darkroom Cabinet

[*Continued from page 99*]

following this, put the back of the cabinet in place.

The latter is cut from ¼-inch plywood and is 25 inches high and 29 inches long. The back is held in place by nails driven into the corner post, only after you have made sure that the length just runs the distance from the outer edge of one corner post to the other. When the edges match perfectly, nail the piece in place using finishing nails 1¼ inches long and spacing the nails about an inch apart.

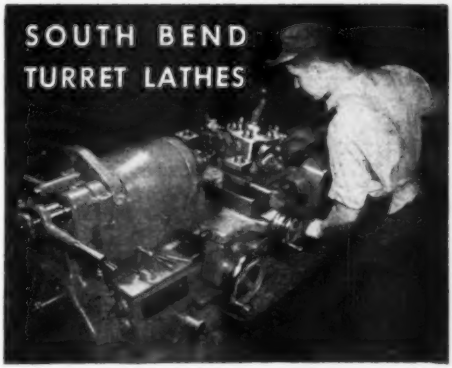
When this is finished, erect the plywood panel which forms the top of the changing compartments. The panel is cut to fit snugly between the wall erected at the left corner post and the wall dividing the shelf. When the top of the compartment is in place, fasten strips of the ½x½-inch pine moulding in place along all the joints, taking care that the strips fit properly. Also run a ½x½-inch strip along the front of the shelf, fastening it in place ¼ inch away from the front edge of the shelf. Then cut a piece of ½x½-inch strip to fit across the top of the compartment and nail it in place ¼ inch from the outer edge of the top panel.

The best procedure is to cut these strips slightly longer than they should be and then sand-paper the ends until they form a tight fit. The changing compartment will then appear as in the illustration at the bottom of page 98.

Now, erect a similar compartment at the other end of the top shelf to hold enlarging paper. Small shelves, an inch apart, will enable you to keep various contrasts and surfaces on each level and prevent their becoming mixed. A door fastened with hinges to the front corner post at the right will enable you to gain easy access to your paper supply. A bird-cage spring fastened to the back

[*Continued on page 173*]

"I always go around the corner on two wheels—it saves the other two tires!"



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Case Hardening In Colors

[*Continued from page* 129]

steady motion, keeping it moving all the time.

While quenching, the solution must be kept moderately agitated by an air jet in bottom of can; not too much pressure—just sufficient to keep entire solution bubbling throughout, as this is what produces the beautiful mottled color effect.

There should be no scale formed on the work—and there won't be any if the work is heated on a brick as suggested. Holding it in the air in an unshielded flame is almost sure to produce scale and so spoil the job. Adjust the blowtorch for a strong, blue flame with plenty of pressure. An acetylene welding torch may be used for quick action, provided only the long blue flame is used, with the "feather" or welding flame held at least six inches from the work.

For a quantity of small parts, it is faster and more convenient to heat them directly in a cyanide pot—any small castiron pot of about one pint capacity, using sufficient cyanide to cover them when melted. This may be heated over a plumber's gasoline blast furnace, augmented by a blowtorch flame directed into and around the pot (Fig. 6) but remember, the work *must* be brought to a bright red or red-orange heat. Larger parts are best handled in a small gas muffle furnace of about one cubic foot internal capacity, using pieces of firebrick to hold the work off the bottom of furnace, and using an old iron spoon to cover them with the powdered cyanide.

Don't use tongs for handling the work, as the jaws will leave unsightly marks when quenching. Attach suitable lengths of plain iron wire, untinned (baling wire is excellent), *loosely* to the parts. Screws and other very small parts are best held in a small wire strainer surrounded by bricks on three sides, Figure 5, and strainer and all may be dipped into the solution.

In small shops where an air compressor is not available, a sufficient jet of air for the purpose may be had from an old inner tube, well inflated and connected by a length of rubber tubing with a common fountain syringe clamp as a shutoff valve; Figure 3. For the experimenter and home-shop worker, a husky lungful of air blown steadily through a piece of tubing, is ample, as the air is required for only the few seconds while the tube is cooling. From two to five pounds pressure is usually sufficient for any work, depending on the quantity of quenching solution used.

CAUTION WHEN USING CYANIDE! Cyanide of Potassium is one of the deadliest and fastest working of all poisons—capable of causing instant death—*yet perfectly safe to use when proper precautions are observed.* A commonly used carburizing agent in thousands of shops, it succeeds, by the method herein described, the former complicated and costly methods of color hardening by means of charred leather. Moreover, when carefully handled, it is no more dangerous to use than several commercial hardening compounds, which contain large proportions of cyanide—though generally more effective than any of them.

Chemically pure cyanide, obtainable at drug stores, is far too costly for shop purposes, and no better than the cheap industrial grade, which is handled by machinists' supply houses, either in coarse powdered form, or in lumps the size and shape of bantam's eggs. These "eggs" are suitable for melting down in a cyanide pot; but when necessary to pour the cyanide over the work, they must be pulverized. Wrap them in several thicknesses of muslin, and crush with a hammer, and wash your hands when through handling.

A cyanide "egg" dropped into hydrochloric acid forms the lethal gas used for executions in many states; and even in water, forms a similar deadly gas, though more slowly. Conceivably, the fumes from melted cyanide, in a close room, could prove dangerous if not deadly—though I've never heard of an accident from this source. However, common prudence dictates that the following precautions be observed:

When hardening with cyanide, have ample ventilation, with a fan blowing the air away from the operator, toward an open window.

Avoid leaning over the melting cyanide or the quenching pot; or inhaling any fumes.

Avoid getting bits of cyanide on the hands, and do not rub the eyes, nose or mouth while using.

Wash the hands thoroughly, then wash the face, when through using.

Finally, keep the supply of cyanide in a friction top can with a flaming red POISON label prominently displayed, and keep it out of reach of children or casual visitors.

Cyanide is too useful and valuable a chemical in industry to be overlooked . . . and actually it is no more dangerous, when properly handled, than many soldering acids, pickling and plating solutions, and other compounds in everyday use. Even your old faithful blowtorch could cause death if you were fool enough to lean over it and inhale the flame!

Show Your Colors For Fourth

[*Continued from page* 139]

in; two being 3½" long and two 3" long.

Paint them all with shiny enamel; colors are suggested in the squared illustration. An electric fan placed near the holder, but concealed from direct view, can produce an additional effect by blowing the flags.

If the holder is to be placed on a glass or polished surface, rubber headed tacks or a felt pad may be added to the under side of the base to prevent the wood from marring the finish under it. The units may be used in groups where a large space is to be decorated.—*R. L. Fairall.*

Darkroom Cabinet

[*Continued from page* 171]

corner post at the right and to a piece of wire on the inside of the door near the hinges will slam the paper compartment closed the moment you release the door.

Following this, put the outer side walls of the cabinet in place. These pieces are cut 25 inches high and 17 inches wide. Fasten the sides in place, as before, with brads driven about an inch apart.

Now, cut the plywood panels for the door, which is made in two sections and is hinged to the corner posts at each end. A small door-catch will hold the doors together.

At this point, it is well to cut the panel that forms the front of the changing box. This piece is cut so that it fits exactly into the opening of the changing compartment. It is held in place by four small sliding bolts. Before you put the sliding bolts in place, cut the two holes in the panel to which the lightproof sleeves will be fastened. These holes are 5 inches in diameter and are cut so that the centers are 12 inches apart.

The sleeves are cut from black rubberized cloth folded over double and are turned over when the ends are seamed together. You will need four pieces of cloth 12 inches wide and 20 inches long. The sleeves are fastened to the plywood door in the following manner:

The sleeves are allowed to project 1½ inches from the back of the panel and are then glued in place with any good mucilage. Following this, cut two cardboard disks 8 inches in diameter, and in the center of each cardboard disk, cut a 6-inch hole. Place the resulting rings over the sleeves where they are glued to the panel and fasten the disks in place with small carpet tacks. The sleeves are held tight around the operator's arms with rubber bands.

The final steps consist of putting the top of the cabinet in place and fastening four casters to the bottom of the cabinet. The top is cut so that it fits flush with the outside edge of the framework and is then nailed in place. Following this, turn the cabinet over and fasten the casters to the corner posts of the framework. Stain or paint the outside to suit your personal tastes.

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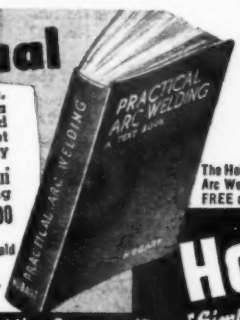

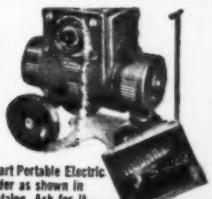

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Now You Can Fly Straight Up!

[*Continued from page* 67]

And when Sikorsky speaks of big planes he speaks with ample knowledge, for as early as 1913 he had already built what was then the largest airplane in the world. Since that time his giant multi-motored airliners have gained international fame for their speed and luxury. Among his foremost designs are the giant 4-motored flying boats and amphibians that bear his name, and that have contributed so much to the safety and comfort of aerial transportation.

Born in Kiev, Russia, Mr. Sikorsky came to the United States 22 years ago, and since that time has produced many of the nation's greatest aircraft for both war and peace. It is not surprising that he should now add the first wholly successful true helicopter to his long record of achievement. He feels that this one will have its greatest possibilities in time of peace, although its usefulness in war is also apparent. Among the military possibilities for the helicopter are liason work, rescue work on land or at sea, observation, submarine spotting, and the rendering of quick medical assistance.

To fully appreciate its possibilities under all circumstances it is only necessary to tell a few of the things it has already done. With Mr.

[*Continued on page* 175]

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All blueprints sent postpaid

Motorize Your Bike

[*Continued from page* 117]

are based on the use of a Briggs-Stratton ½ h.p. washing machine motor and minor changes may be required for other types of motors if used. In any case the amount should be built up and welded into the general shape and size indicated in the drawings. It is bolted to the upper rear forks and supported from the lower forks by two pipe braces.

The clutch lever, which operates the idler pulley already mentioned, is mounted on the bike frame as shown. A simple quadrant cut from sheet metal to the general shape given in the detail sketch, Fig. 4, is used to hold the clutch lever in the required positions. Both lever and clutch rod are made from old auto brake rod and, incidentally, if you are thinking of building one of these "jeeps" it would be wise to get the parts soon—auto junk yards are on the way out and may soon be only a sweet memory.

The throttle is handled in a neat manner. As shown in the detail sketch, see Fig. 4 again, a simple twist control is made by bending a sheet metal sleeve round the right handlebar and then forcing the rubber grip over this sleeve. The sleeve itself is held in place by means of a small lip which is bent into a slot sawed into the bar. A further projection on the sleeve is bent up and acts as a lever which is connected to the throttle wire as shown. The actual throttle wire can be made from an old car choke wire of the flexible type.

The spark control, not indicated in the drawings can be arranged to suit, either on the handle bars or on the bike frame itself.

The belt tensioner as shown in the detail sketch, Fig. 4, is quite simple. Since on this type of conversion the tensioner is applied to the outer surface of the belt, a flat surfaced pulley is required. On Pitlick's conversion a Ford V 8 clutch pilot bearing is used for the pulley and any similar bearing will do for your job. The tensioner on this job is hinged to the stud which ordinarily holds the starting pedal on the Briggs-Stratton motor. If other types of engines are employed the hinging of this tensioner will have to be worked out individually, but it is a small matter in any case.

A coil spring should be attached to the tensioner arm and run to the motor frame so that there will always be a slight tightening action on the belt when the clutch lever is not in neutral position, or, pulled way back as shown in the detail sketch of this member.

The exhaust extension can be run down the fork frame as shown or a muffler may be added. In fact in some states it may be compulsory to add a muffler though on small motors such as are under consideration here a long pipe is generally sufficient to take the racket down a peg or so.

On this type of conversion no changes whatso-

[*Continued on page* 176]

Now You Can Fly Straight Up!

[*Continued from page* 174]

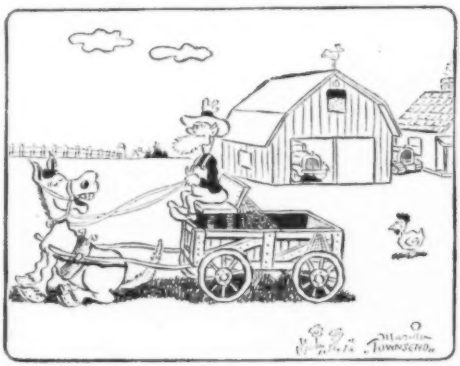
Sikorsky himself at the controls, the helicopter early in its career, broke the world's endurance record for ships of its type. And it must be remembered that it was the first successful single main rotor helicopter in the world.

Since then it has performed all sorts of hitherto impossible feats. On one occasion it hovered motionless in the air a few feet above the ground while an attendant removed one of its landing wheels. It remained in the air over the same spot while photographs were taken, then the wheel was replaced for the landing. At other times packages have been placed aboard by assistants on the ground while the ship "parked" in the air close to the ground. It has landed and taken off vertically in tiny spaces hemmed in on all sides by trees and obstructions, places where no other aircraft in the world could possibly have operated.

It can't stall or spin under any conditions, and so would provide an unparalleled factor of safety in the hands of a non-professional flyer, and it can be handled easily and safely even if the engine stops in the air. It travels in any direction simply by "tilting" it with the controls, and it can climb or descend either vertically or on the slanted course common to conventional aircraft—all by a few simple movements of the throttle and controls.

It does all these things with the power provided by an ordinary airplane motor developing the same amount of power as the motors in the private ships that fly over your house every day, about the same power that drives many a family car—90 horsepower.

Its designer flies it in a business suit and a felt hat, and although he sits in an open cockpit directly below the rotor that carries the ship straight up into the sky, his hat never blows off. There's no trick to the hat, but the wind blows downward in a helicopter. And that's just one more advantage it has over the roadsters we've been driving around for the past quarter century.



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WAR BONDS AND STAMPS

FOR VICTORY

Motorize Your Bike

[*Continued from page* 174]

ever are required on the bike frame, but it is well to go over the whole bike before installing even the lightest motor. An article on bike conditioning, "Back to the Bike" appeared in the May issue of MECHANIX ILLUSTRATED, and we advise the prospective builder to peruse this carefully before hitching a Ford V 8 to his bike. A front wheel brake is a thoroughly good idea too, but not essential.

The drive pulley as originated by Mr. Pitlick is used on both types of conversions. It is most ingenious and not hard to install. The pulley itself is turned from curly maple or any similar hard wood and, for general purposes, should be about twelve inches in diameter. In hilly districts a larger pulley may be advisable but the diameter given is sufficient for motors of one half horse power in average terrain. The motor pulley should be metal and not more than 1½ inches in diameter if the 12-inch drive pulley is used.

Turn the drive pulley as shown and groove it for a standard half inch belt. To install the pulley first remove the rear wheel from the bike and take off the tire. Then, using a steel punch, inset the rim at the four points of attachment so that the bolts will not tend to project into the tire. Details of this and the whole pulley assembly are shown in the detail, Fig. 6. The pulley brackets are made from half inch iron or steel strap. Actual dimensions are dependent on the diameter of the wheel used but in any case these braces should be bent and cut so that they come to *within one-half inch* of the rim. Tightening the bolts at each brace results in the pulley occupying a centered suspended position, and imposes a minimum load on the spokes against which it rests but is in no way directly connected.

This about completes the conversion. The inboard type of mount as shown in Fig. 2 and other sketches is substantially the same but is built into a girl's type bike and affords better stability and all round balance.

The same drive pulley is employed and the same general type of belt tensioner though in this case, with the tensioner acting on the inner surface of the belt, a standard 1½ inch vee pulley is used for the idler pulley.

The motor should be bolted down to the angle iron motor frame on short pieces of valve spring for best and smoothest performance. The mount itself is cut out as shown in the detail, Fig. 7, but actual length and cutting will depend on the motor employed as well as the bike frame itself. The motor mount is clamped to the frame and affords a solid platform without the necessity of drilling or welding the bike frame in any way whatsoever. Dimensions given in the drawings covering this installation are based on the ½ h.p. Lauson engine type RLC but any similar motor up to about 2 h.p. can be mounted in this manner.

Sidecarette

A simple side car will greatly add to the usefulness of your motorized bike. The average motorcycle sidecar is designed specifically for the large heavy motorcycles in general use today and is useless for our purpose. The sidecarette shown in Fig. 9 and other sketches is not too difficult to build and may be modified in many ways to suit the material on hand. The overall dimensions will prove handy as they are based on the comfortable seating of a six foot adult—not a small child.

A 26"x2⅛" wheel and tire is advisable. Angle iron can be used for the chassis but the pipe as indicated will make easier fitting. In ordering pipe and pipe fittings it must be remembered that pipe sizes are always given as the inside diameter rather than the outside. Thus a ⅜" pipe is actually 9/16" in diameter.

Note on the sidecar chassis how the pipe sizes are varied and how reducing tees and ells are employed to make this variance possible. All joints should be welded to strengthen the structure.

The body may be built as shown or even lighter. A good type of side car body might be built much like the geodetic Canoe which appeared in HOW TO BUILD 20 BOATS, No. 7.

In any case the prerequisite of the body is strength and lightness. The style shown is all plywood with stiffeners where most strain is likely to occur. A simple canvas seat may be used or the conventional type built in. The body is mounted to the chassis by valve springs in the front and slung in C springs at the back. If these C springs are not obtainable the suspension can be modified to suit. When not regularly occupied the sidecar should be strapped down to the chassis to prevent annoying bouncing. A simple box carrier can be employed instead of the body as shown if the outfit is required for light delivery work.

BUILD FROM BLUEPRINTS!
See special list of craft blueprints on page 174.

ANSWERS TO CRAFT TEST ON PAGE 143

1.—"A" is for A.C. "B" is for D.C.
2.—Series connection at A
3.—Pour acid into water for safety
4.—Specific gravity of 1.195, approximately
5.—Ohm's Law
6.—Size found by hole into which wire fits.

Even Hollywood's Cars Are Glamourized

[*Continued from page* 40]

Susie. Rolls-Royces, Packards, Cadillacs, super-Buicks, and Chryslers that elicit whistles of admiration on the show-room floor don't satisfy dough-heavy movie stars (and numerous playboy millionaires and peers) until Howard Darrin has glamourized them into futuristic dreamboats a block long and of apparently limitless speed. You've seen some of them in films, and a new Darrinized job is shown here—but it's still a stock chassis underneath all of them.

Darrin's chief tools are metal shears and a welding electrode—and a lively imagination. A good designer and crafstman, he draws on several years' experience in Paris to devise new versions of the Europeanized auto bodies which until the war were the last word in swank and glitter.

As indicated by the photographs of Bill Marshall's new Darrin job, the hood is lengthened by a specially-shaped snout. Here it gives a Packard a Buickish look. However, the Packard fenders have been replaced by Cadillac ones, and the shiny massiveness of the bumper is strictly from Oldsmobile! The heavily-defined speed line across the doors and the very special feature of the couch seat beside the driver (a lever lowers the back, turning the leather seat into a bed!) are two of Darrin's ideas for this car that make the owner, a young M-G-M contract player, highly envied when it purrs down the street.

Marshall got the completely glamourized convertible for $6,000, which includes the cost of the original automobile. That was a fairly routine assignment—Darrinizing often runs up to $25,000, partly because the original car may be any of the costliest American-made cars or a Rolls-Royce, Dusenberg, Bugatti, Mercedes-Benz, etc. Reshap-

[*Continued on page* 178]

"There goes Jackson wasting it on his hair again!"

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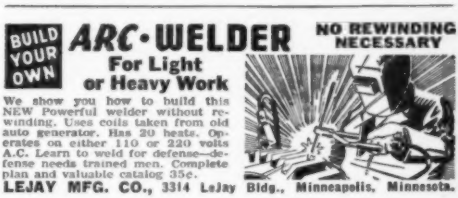
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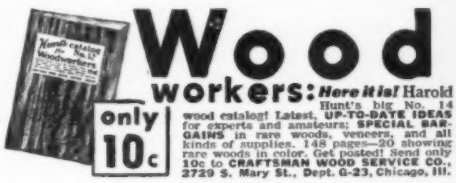
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Even Hollywood's Cars Are Glamourized

[*Continued from page 177*]

ing a car along Darrin's unique and advanced lines takes from three to eight weeks—longer now, since supplies are hard to get. The futuristic, distinctive appearance of Darrinized cars gives them a longer style life than stock automobiles.

The car-glamourizer used to Darrinize Fords in his spare time for thrilled high school students owning near-jaloppies, but has been forced to discontinue that unprofitable fun. That he devoted as much extra time and talent to Fords as he did may have been out of memory of the fact that it was a Ford he glamourized for Stephen Morehouse Avery, the writer and scenarist, which set him on the road to his present lucrative business and recognition of his unique service. The influence of his ideas built into special jobs for Hollywood stars and socially-prominent persons is evident in the increasing sleekness and streamlining of stock automobiles, Darrin's admirers point out.

Darrin's training was received in France, to which he returned after the first world war because he'd found home dull in contrast to the excitement of war days. In Paris he joined a man named Hibbard in designing expensive, individual automobiles for the restless, moneyed elite of post-war Europe. The men's cars won the Paris Salon design prize consistently, and—more profitably—received the further accolade of orders from such car-fanciers as the King of the Belgians. He ordered two special jobs, and was so pleased that he decorated Messrs. Hibbard and Darrin with medals!

The late King Alfonso, Spain's sportsman monarch, liked his special Dusenberg with a Hibbard and Darrin body so much that he chose it in preference to eight other sleek, high-priced motors in the royal garages when he had to flee his throne into France.

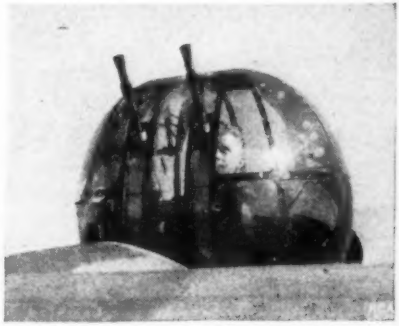
Hibbard ultimately turned to another business, and Darrin returned to the United States with his knowledge of new ways of making vehicles look swift, unconventional ways of upholstering, and novel suggestions for built-in gadgets and comforts. He naturally turned toward Hollywood—home of the luxury-loving, money-heavy crowd most likely to be his best market. While Hollywood has always been a paradise for salesmen of big cars, its members didn't realize that Darrin was a man after their hearts until he completed the transformation of the Avery Ford earlier mentioned. The well-traveled writer had seen numerous eye-stopping examples of the Darrin witchery in Europe and knew what was possible. The result still fetches a crowd when it's parked though its age should qualify it for the scrap-metal heap that's feeding our war machine.

Dick Powell, then advancing into the big money, saw Avery's Darrinized car one day, studied it, and finally found the designer's metal tag inconspicuously hung at the base of the radiator. He had secretaries locate Darrin, and gave him an enthusiastic go-ahead on a typical glamour car, first of a series which now grace West Coast highways. Darrin ordered the chassis, engine, frame, and four wheels of one of America's oldest and now medium-priced automobiles. Not cheap, not expensive—a midway make. Darrin changed springs, shortened the shaft, lengthened the hood, reshaped the fenders, widened the body, reslanted the windshield, and tucked, snipped, poured, cast, and painted a truly deluxe dream-buggy that looked 20 years ahead of its time.

Now the roster of his clients also includes Clark Gable, Marlene Dietrich, General John J. Pershing, Chester Morris, Errol Flynn (who took delivery of a Darrin job just a few weeks ago), Tom Brown, Walter Brennan, Jack Warner, Norma Shearer, among others.

Not to mention seven kings!

GUNNERS UP!

What does a bomber's gunner do, think, and feel during a raid? How, in short, does he get that way?

RCAF Flying Officer Jack Scherer, former MI editor whose "Bombardier" article telling the work of the gunner's fellow-fighter is one of the features of this issue, describes the important tasks, training, and background of this important member of a bomber crew. Illustrated by dramatic photographs lent from the RCAF files, this exciting, authoritative description will be just one of the many fact-packed, absorbing features of next month's MECHANIX ILLUSTRATED, on sale July 1. Reserve your copy now!